JULY, 1953

TOOLING and PRODUCTION

The Magazine of Manufacturing Management

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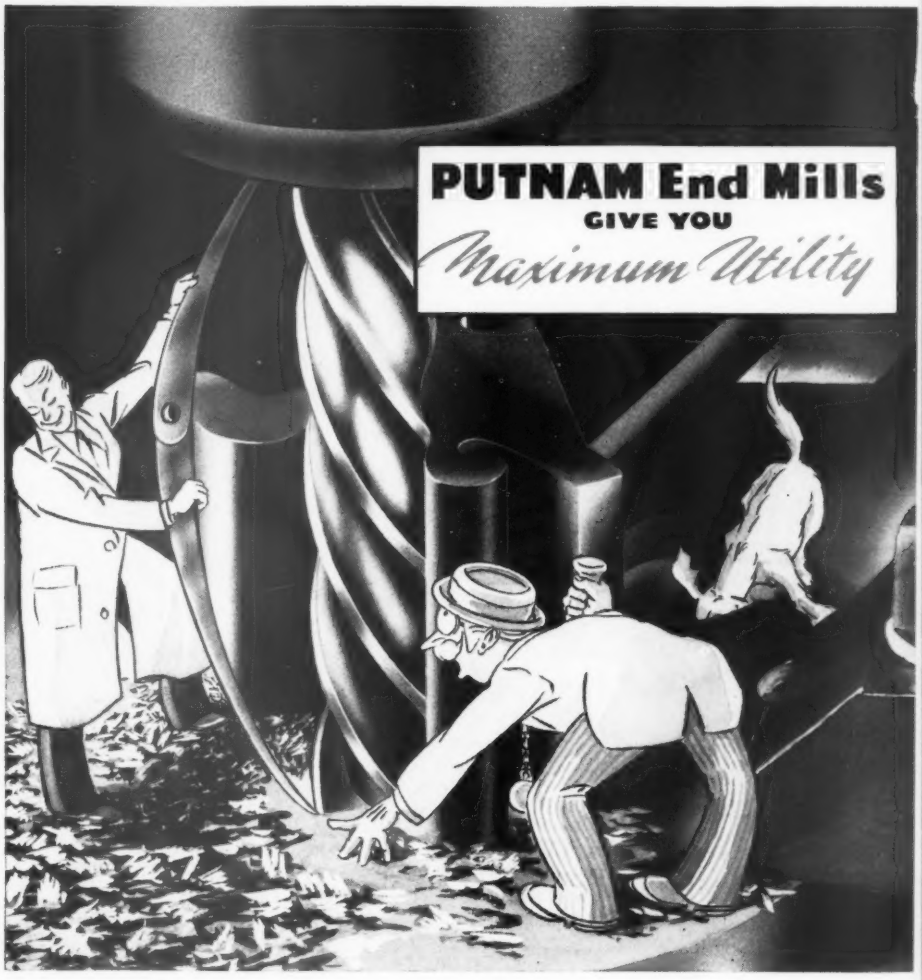

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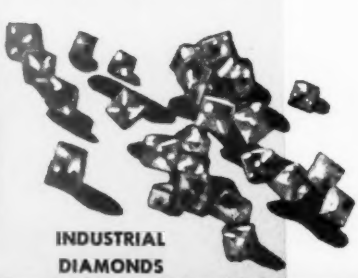

INDUSTRIAL DIAMONDS

"Bloomin Idol made o' mud— wot they called the Great Gawd Budd"

—KIPLING

The two French soldiers crouched and watched the white little beam of Indian sunlight creep into the eye of the great gilded image across the shadowy chamber. Suddenly, the eye blazed and flashed with brilliant, jewelled fires.

"Diamantes!" they whispered, and rushed over and clambered up to the great face. A few moments later they ran out into the turmoil and gunfire in the streets and fled with the rest of the French soldiery, retreating before Captain Clive's victorious Sepoys.

A diamond as big as a walnut and weighing 200 carats isn't the easiest thing to trade, but, eventually, it reached an Armenian dealer who sold it to the Russian Count Orloff for $560,000. The Count diplomatically presented it to the Empress Catherine, who was so pleased that she gave him a half-million dollar grant and another title.

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TOOLING and PRODUCTION

The Magazine of Manufacturing Management

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Vol. XIX—No. 4 July, 1953

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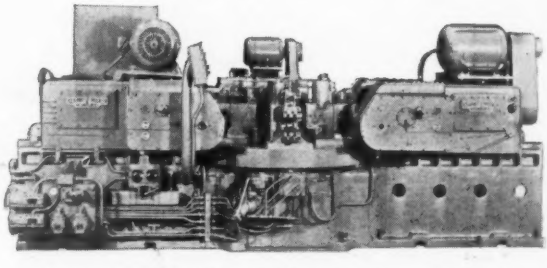

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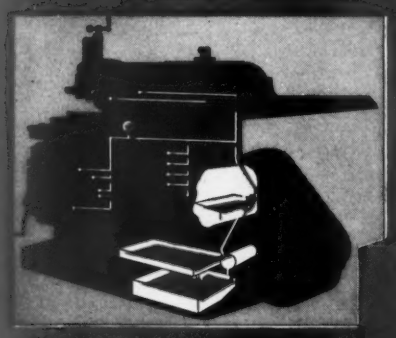

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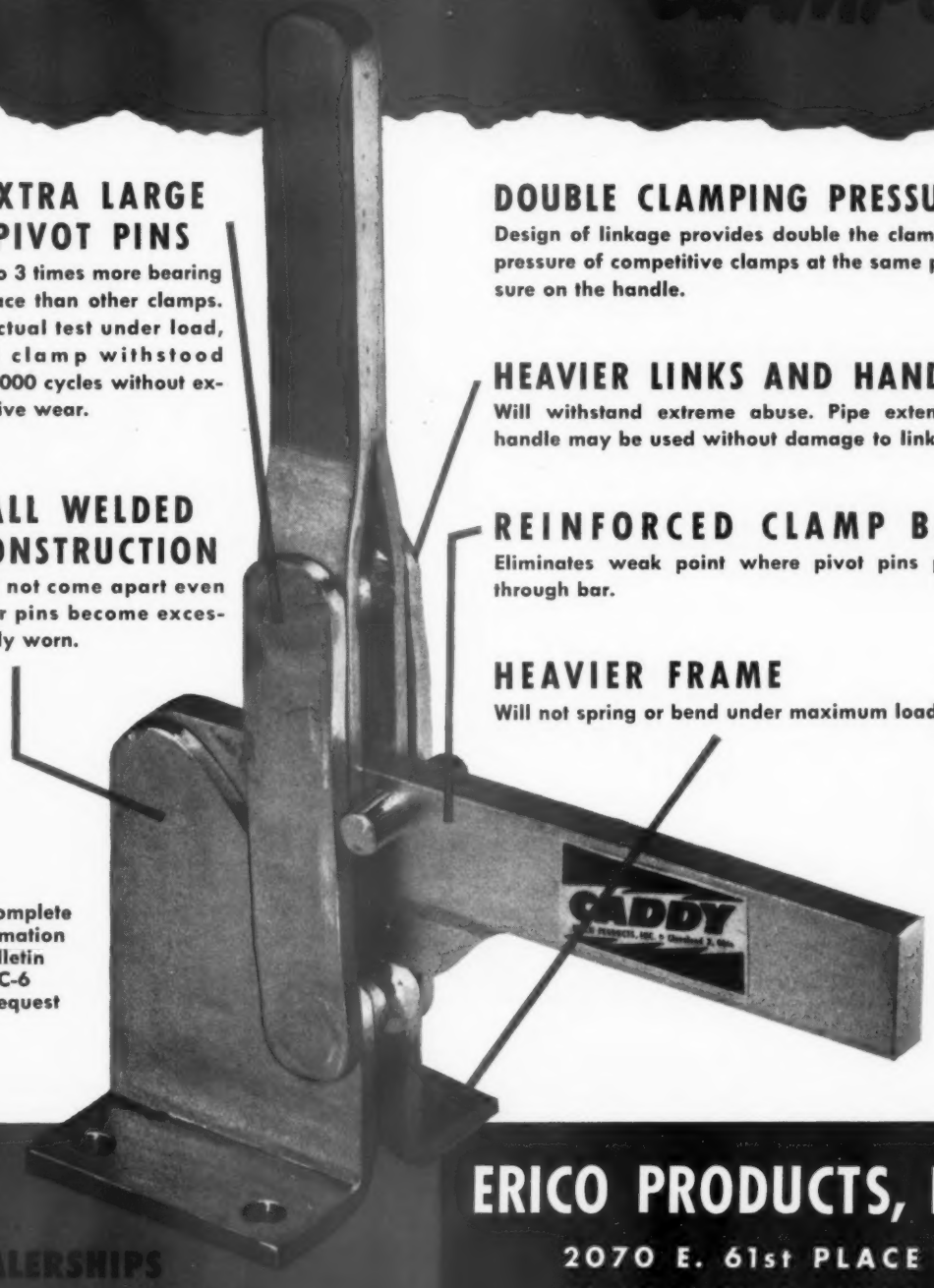

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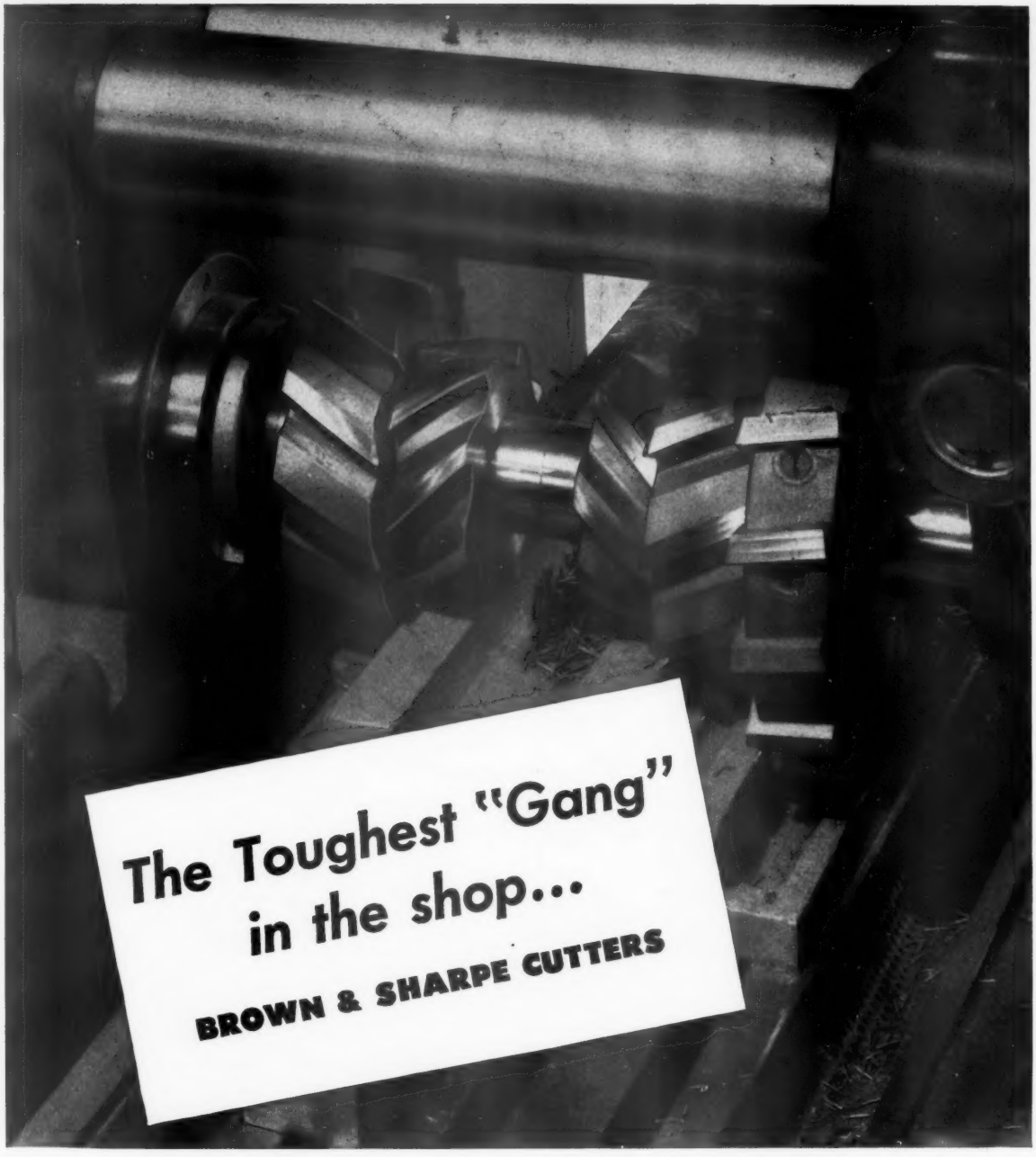

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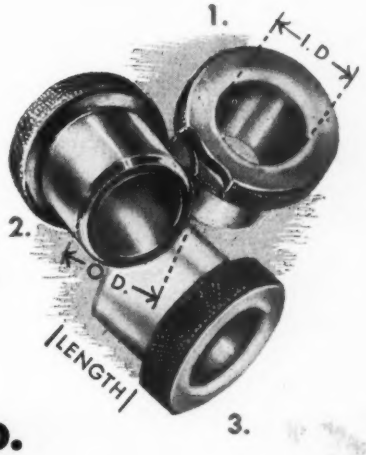

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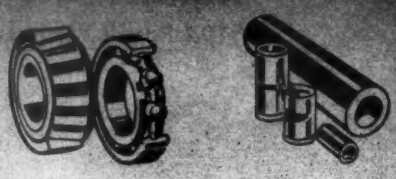

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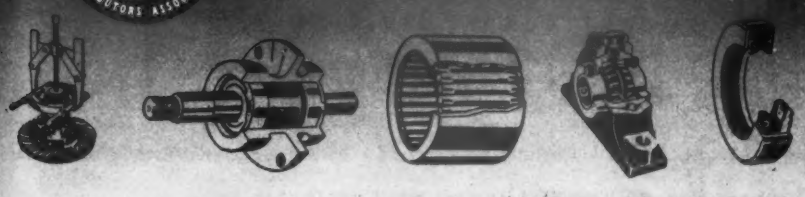

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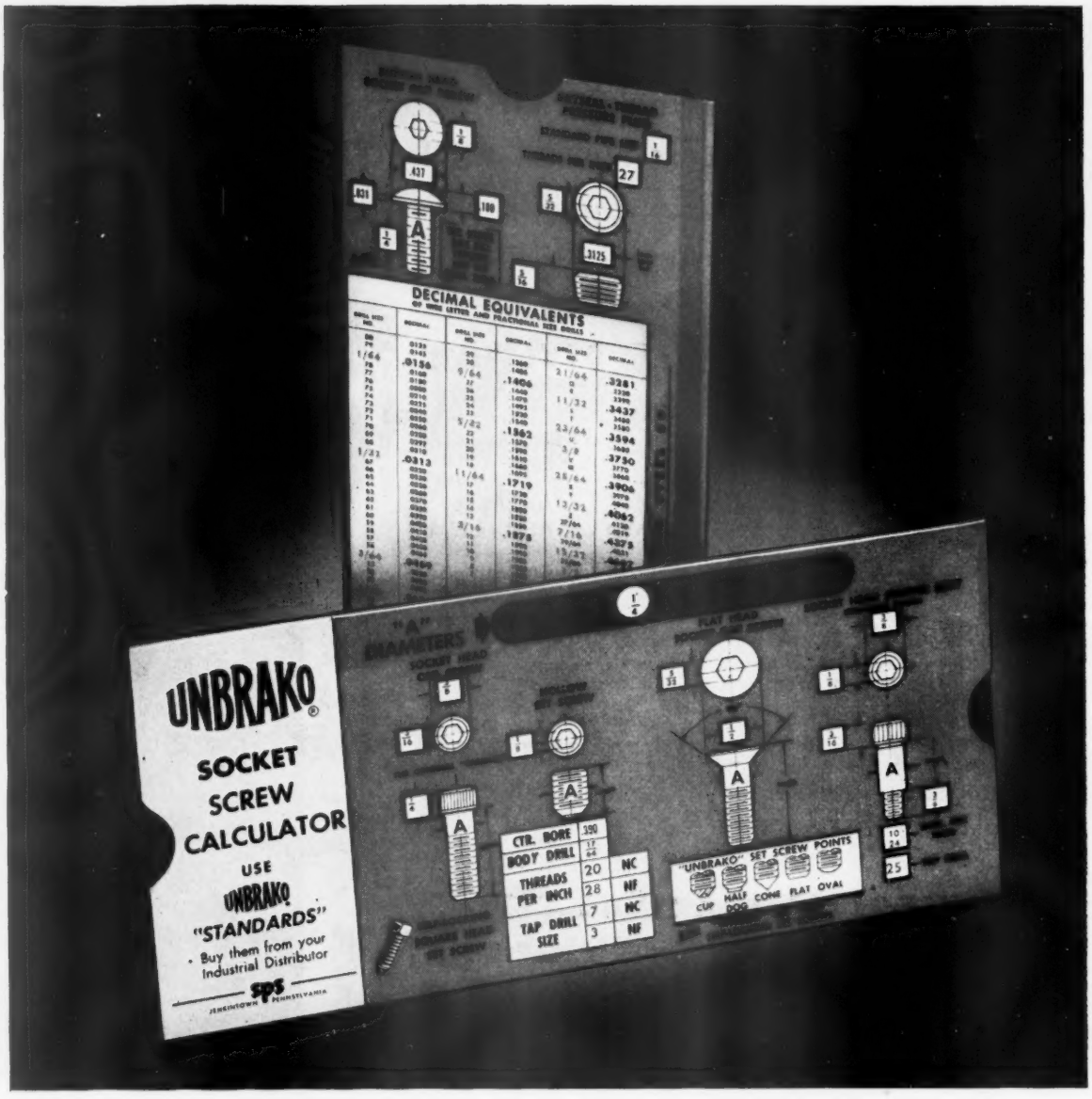

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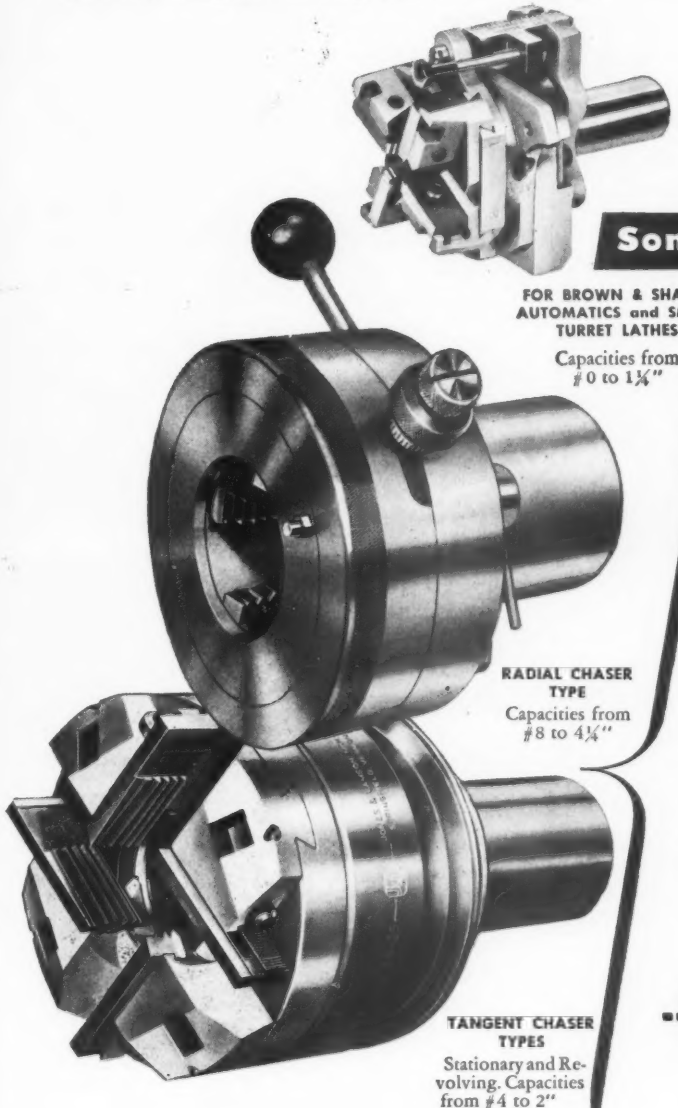

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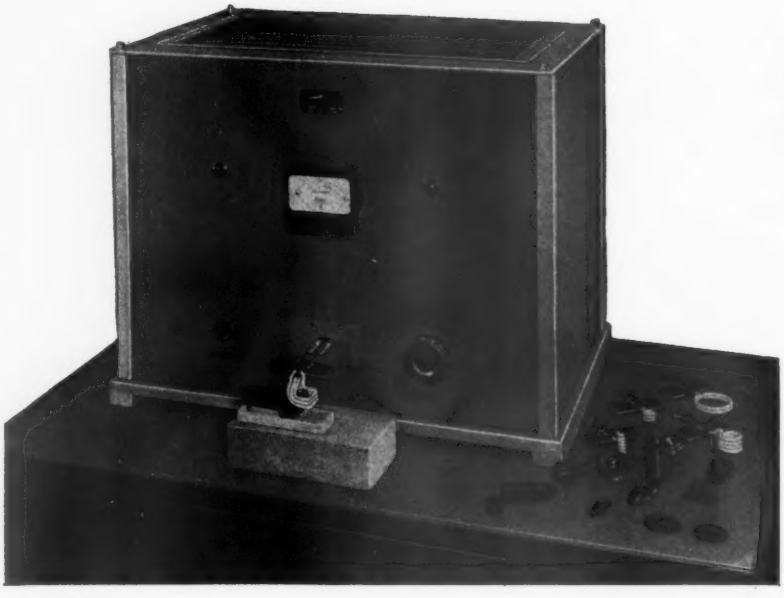

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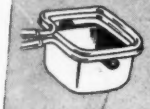

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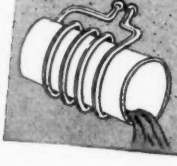

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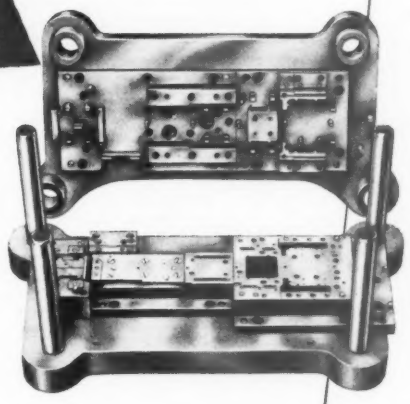
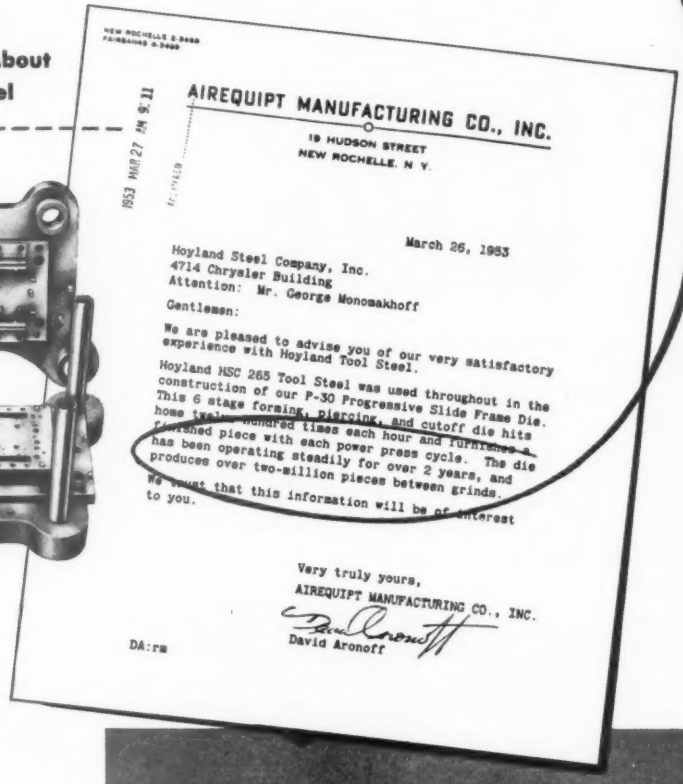
Has Been Operating Steadily For More Than 2 Years!

Here's What The Airequipt Manufacturing Company Says About Hoyland "HSC 265" Tool Steel





AIREQUIPT MANUFACTURING CO., INC.
19 HUDSON STREET
NEW ROCHELLE, N. Y.

1953 MAR 27 AM 9:11

March 26, 1953

Hoyland Steel Company, Inc.
4714 Chrysler Building
Attention: Mr. George Monomakhoff

Gentlemen:

We are pleased to advise you of our very satisfactory experience with Hoyland Tool Steel.

Hoyland HSC 265 Tool Steel was used throughout in the construction of our P-30 Progressive Slide Frame Die. This 6 stage forming, piercing, and cutoff die hits home twelve hundred times each hour and furnishes a finished piece with each power press cycle. The die has been operating steadily for over 2 years, and produces over two-million pieces between grinds.

We trust that this information will be of interest to you.

Very truly yours,
AIREQUIPT MANUFACTURING CO., INC.
David Aronoff

DA:ra

PROGRESSIVE SLIDE FRAME DIE

Made Of Hoyland "HSC 265" Alloy Tool Steel

Illustrated are die set and die used by the Airequipt Mfg. Co. of New Rochelle, N. Y. for precision stamping of frames for their slide changer. Die is a six-station piercing, forming and cut-off. Die set is a special four-pin produced by The Producto Machine Company of Bridgeport, Conn. Feed is special high speed automatic and die turns out 12,000 pieces per hour with almost no rejects.

About "HSC 265"...

"HSC 265" is a high carbon–high chromium steel which was developed primarily for dies which had to be exceptionally resistant to wear. It is deep hardening and has a combination of extreme hardness and great toughness. "HSC 265" is classed as non-deforming and is particularly free from any inclination to warp during heat treatment. It retains a satisfactory degree of hardness at temperatures harmful to carbon steels and low-alloyed tool steels. It is excellent for such uses as: blanking dies, broaches, deep drawing dies, forming dies, knurls, lathe centers, punches, lamination dies, plug gages, rolls, spinning tools, shear blades, plungers, slitting cutters, thread rolling dies, swaging dies.

Looking For A Special Tool Steel?

Or a dependable source for standard tool steels? Need some help in solving a tough tool steel problem quickly? Perhaps our many years of tool steel experience and our inventory—one of the largest in the country—can help. We'll be glad to consult with you.

HOYLAND STEEL

HOYLAND STEEL COMPANY, INC.

405 Lexington Avenue * New York 17, N.Y.

Western Division—Great Western Steel Co., Inc.
1011 East 61 St., P.O. Box 4937, Florence Sta., Los Angeles, Calif.

Warehouse Facilities: New York • Newark • Boston • El Paso • Los Angeles

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18" wheel on motorized spindle, driven by heavy-duty 15 HP motor.
Table elevating mechanism — completely enclosed for protection from grit or coolant.
Cross feed adjustment — graduated to .00025" for convenience in setting.
Longitudinal feed—designed for easy, fast operation.
18" FACE GRINDER

Quick Set-up Speeds Production

The Abrasive 18" Face Grinder handles big work, odd shapes and special fixtures — gets out grinding jobs fast and efficiently. By removing the Plexiglas guard, the 13" x 36" work table is completely "in the open" — fully accessible for fast, easy set-up. Transverse and vertical adjustments are by large, conveniently located handwheels.

Longitudinal hand feed also saves set-up time and eliminates table overrun.

Abrasive 18" Face Grinder has many uses — faces off castings, grinds automobile dies, squares up die blocks, snags castings, does many other jobs where flat, square surfaces are required.

Write for complete details and catalog. Abrasive Machine Tool Company, 16 Dunellen Road, East Providence 14, Rhode Island.

ABRASIVE
ACCURACY BOOSTS PRODUCTION

Abrasive Quality is Reflected in the Finish of Your Product

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the one source

for "Desegatized" cold work die steels

COBALT CHROME

SELECT B

OLYMPIC

GSN

BR-4

Latrobe is the one source for these "DESEGATIZED" cold work die steels—each of them uniform in structure, non-deforming and abrasion resistant.

Cobalt Chrome . . . for long-run dies, possesses superior abrasion resistance, holds a super keen cutting edge.

Select B . . . a 5% chromium air hardening die steel, easily machined, long wearing, has maximum toughness.

Olympic . . . a die steel perfectly balanced for toughness, wear resistance and machinability, popular for intricate cold work applications.

GSN . . . the oil-hardening steel in this group, combines high hardness and compressive strength with excellent wear.

BR-4 . . . a "bear for wear"—this patented super abrasion resistant die steel provides the ultimate in wear resistance.

The cost of the finished dies you make or use is far too great for you to gamble with expensive failure during or after fabrication because of inferior raw materials. Avoid this risk—specify "DESEGATIZED" die steels for your next cold work dies.

Sole Producers of "DESEGATIZED" Steels

LATROBE STEEL COMPANY

Latrobe, Pennsylvania

Sales offices and warehouses:

BOSTON BUFFALO CHICAGO CLEVELAND DAYTON DETROIT HARTFORD LATROBE (Mill) LOS ANGELES MILWAUKEE NEW YORK PITTSBURGH PHILADELPHIA ST. LOUIS TOLEDO

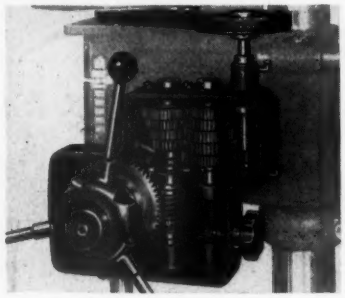
Foreign offices in:

BRUSSELS PARIS GENEVA MILAN ROTTERDAM

GEAR-DRIVEN POWER FEED

CLAUSING

18" HEAVY-DUTY DRILL PRESS



- HEAVY DUTY!
- GEAR DRIVEN!
- INSTANT FEED SELECTION BY DIAL!

BIG TOOL AND JOB CAPACITY — plus HEAVY-DUTY GEAR DRIVEN POWER FEED to take full advantage of it! This Clausing Power Feed drill press has *everything* to save you plenty on both set-up and operating time.

Drills 1" in cast iron, ¾" in steel. The No. 3 Morse Taper spindle travels a full 6½" — makes maximum efficient use of production chuck equipment. 63/64" spindle is bigger, stronger, handles bigger tools. And there's 39" maximum distance from spindle to table.

Clausing Power Feed, with its large heavy-duty gears, is *positive* and *sure* — NO belt slippage to dissipate power. Feed selection is instant — BY DIAL — no belts to change. All this — plus regular Clausing features of *new spindle bearing engineering, vernier depth stop, and exclusive head and table positioning mechanism.*

You can't buy more precision, power, and capacity in any drill press at the price! Get *all* the facts — send for new literature today.

Atlas CLAUSING PRECISION MACHINE TOOLS — DIVISION ATLAS PRESS COMPANY KALAMAZOO MICHIGAN U.S.A.

CLAUSING DIVISION ATLAS PRESS COMPANY
7-115 N. PITCHER ST., KALAMAZOO, MICHIGAN

FOR PRODUCT INFORMATION USE CONVENIENT INFORM-A-GRAM CARD

Only SUPERIOR

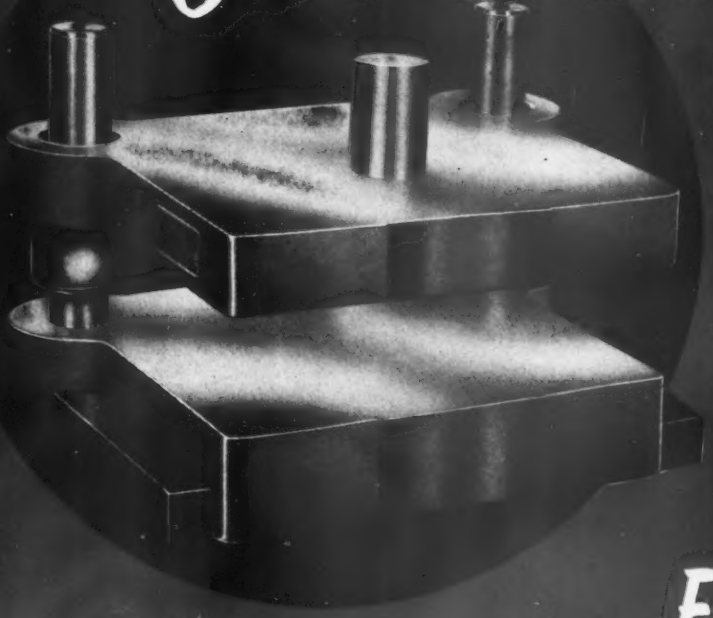
PRECISION—ALL STEEL

DIE SETS

Give You These

3 Features

For Safer Faster Handling



1 SAFETY FLANGE

protects fingers by providing roomy gripping space on either side of the die shoe. This flange may be mounted flush or on the edge of the die set and is welded in place. *There is no extra charge for this valuable safety feature.*

2 LOCK JAW LIFTING DEVICE

removes the danger of handling large die sets. Heavy steel components of this device are welded in place forming an integral part of the die set. They are positioned to insure proper balance when the set is lifted by either chain fall or crane.

3 E-Z LIFT SLING CHAIN

is especially designed to fit the safety flanges of the die sets. Male jaws attached to the sling fit quickly into place for immediate lifting. There is no need for screw clamps, eye bolts, or lifting lugs. Nor is there danger of distorting stresses being set up in the die or set because of improper lifting.

It's no longer necessary to take needless risks in handling die sets. Risks that might easily injure the hands of skilled die makers, ruin costly dies in process or completed, or even damage press equipment. Safety features of Superior die sets have eliminated all of these dangers and have speeded up the overall handling of sets from the bench to the press. Prove to yourself the merits of these safety features in both small and large die sets.

FREE CATALOG—*Write today for this helpful data on Superior die sets and die makers' supplies.*

For Fast Local Service Call these Expert Superior Representatives

- Kalamazoo, Mich.—Phone 7988
- Indianapolis, Ind.—BRoadway 5668
- Chicago, Ill.—CEntral 6-3869
- Dallas, Tex.—Riverside 5138
- Syracuse, N. Y.—2013 James St.
- Rockford, Ill.—Phone 3-3991
- St. Louis, Mo.—Lucas 1223
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- Atlanta, Ga.—ATwood 7771

30 YEARS OF QUALITY-LEADERSHIP

SUPERIOR STEEL PRODUCTS CORP.
2734 S. 19th ST., MILWAUKEE, WIS.

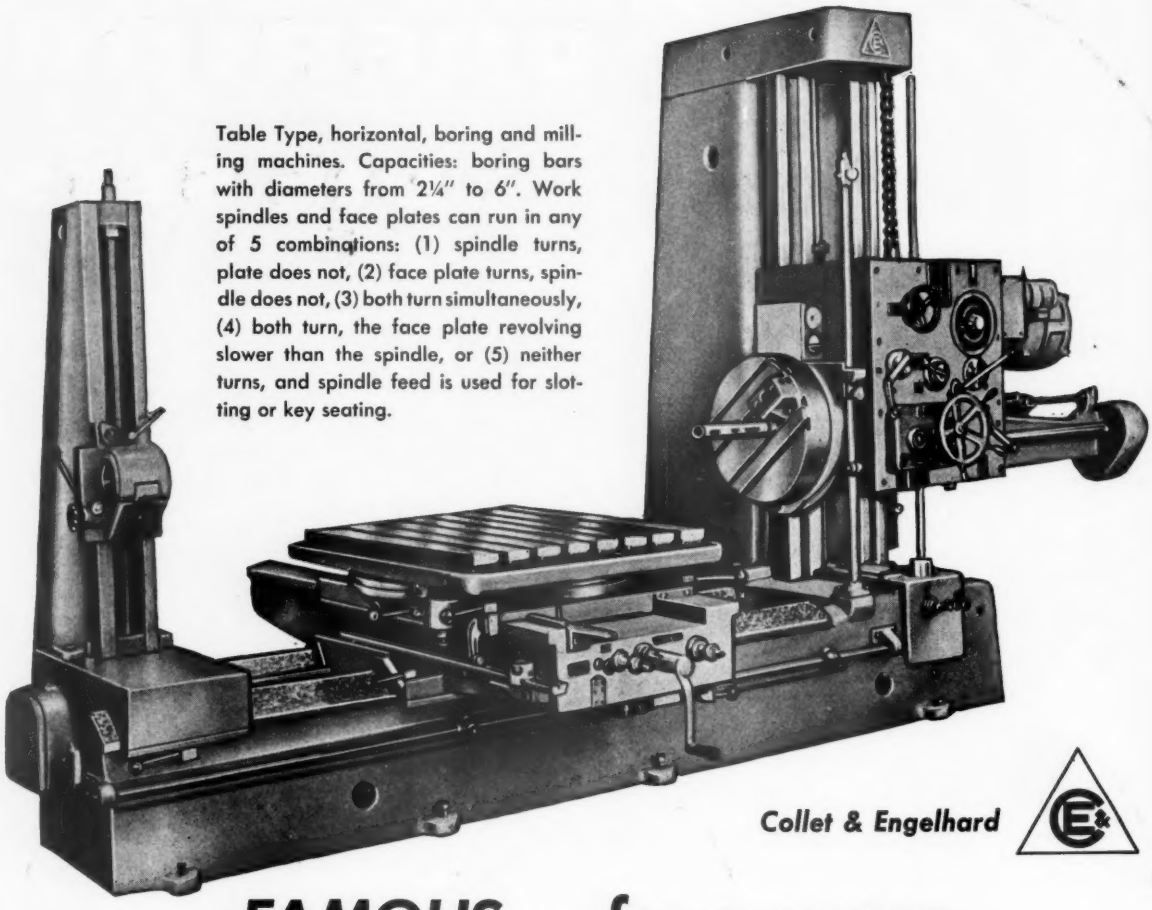

Table Type, horizontal, boring and milling machines. Capacities: boring bars with diameters from 2¼" to 6". Work spindles and face plates can run in any of 5 combinations: (1) spindle turns, plate does not, (2) face plate turns, spindle does not, (3) both turn simultaneously, (4) both turn, the face plate revolving slower than the spindle, or (5) neither turns, and spindle feed is used for slotting or key seating.

Collet & Engelhard

FAMOUS . . . for a reason

work machined on a C & E has a high surface finish

. . . as high as C & E's reputation

Collet & Engelhard are Europe's leading builders of boring and milling machines. The reason—they have been building such machines for 90 years, and they apply the knowledge gained from such experience with painstaking care.

The horizontal boring and milling machine pictured above, a 3" Spindle Machine, is an excellent example of their work. Controls are simple, centralized, and located conveniently. Spindle speeds from 5 to 1600 rpm and face plate speeds from 5 to 250 rpm can be adjusted infinitely, while the machine is running. Spindle has 36 feeds, from .0008" to .472" per revolution and the facing head has 18 feeds from .0008" to .095" per revolution. Compound table and spindle head each have 36 feeds, from .0008" to .472". Boring and milling operations are free from vibration because of the heavy and rigidly braced bed and upright. Lubrication is automatic.

There are other desirable features about this machine—for instance, it has a tool locking and releasing device on the spindle nose that eliminates the ill effects of hammering wedges, it is convenient to set up for thread cutting, it has all possible safety devices, and many other advantages. However, the name of the builder is enough to tell you that it is one of the best machines you can get. Contact us for the complete story and you will soon find out how many of your boring and milling operations can be done better, faster, and safer, on the Collet & Engelhard.

COSA CORPORATION
405 Lexington Ave., New York 17

Your source for all Precision Machine Tools—from Small Bench Lathes to Large Boring Mills

IN DETROIT AREA contact DETROIT-COSA CORPORATION, 16923 James Couzens Highway, Detroit 35, Mich.

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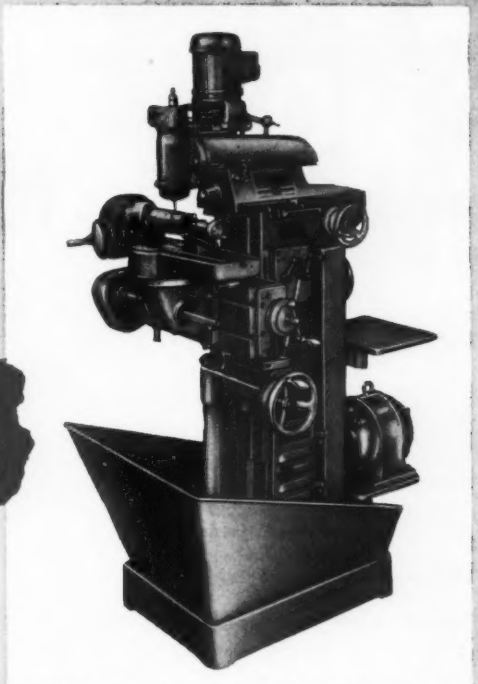
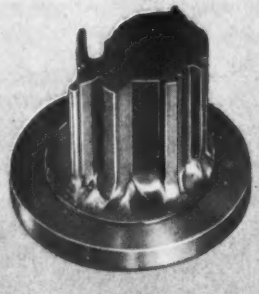
Intricate PIECES MACHINED EASILY AND ACCURATELY ON

DECKEL UNIVERSAL MILLERS

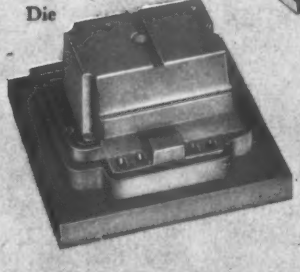


Model FP1 Milling spiral slot using High-speed Vertical Spindle Head and Spiral Milling Attachment

Whether making highly developed fixtures, simple tools or gauges, or odd-shaped parts, you can produce them more efficiently and accurately on a DECKEL FP1 Universal Miller. Production goes up and costs go down because you can accurately perform any type of milling—horizontal, vertical, angular or spiral—plus drilling, boring, or slotting on ONE machine. Eliminate the loss of valuable time caused by waiting for openings and set-ups on single-purpose machines.



Punch



Die

Fitting

Machine Tool Part

Clamping Fixture

For output, accuracy, surface finish, and ease of operation a Deckel Universal Miller is "A MUST" in your tool room or precision milling department. Investigate today, write for a complete catalog or ask for a Cosa engineer to show you how a Deckel Universal will increase production and reduce cost on your work.

Other Deckel Machines for Tooling & Production

2 DIMENSIONAL ENGRAVERS
3 DIMENSIONAL ENGRAVERS
UNIVERSAL PANTOGRAPH DIE SINKER
UNIVERSAL TOOL & CUTTER GRINDERS

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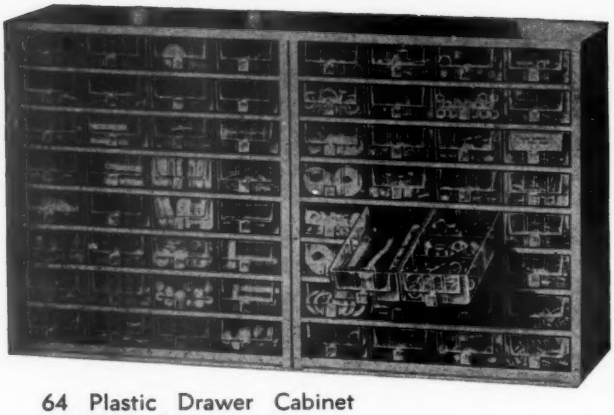
NOW

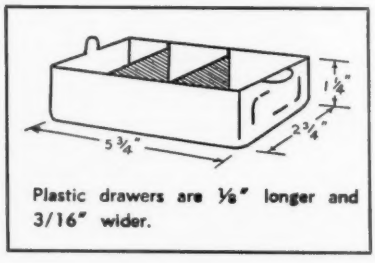
JIFFY CABINETS WITH METAL OR PLASTIC DRAWERS

- **7 useful cabinet sizes**
- **Aluminum or see-thru plastic drawers**
- **Individual drawer guides**
- **Removable drawer-dividers**
- **Safety catch on back of each drawer to prevent accidental spilling of contents**



64 Plastic Drawer Cabinet
(192 Compartments)

Index label and 2 removable drawer dividers for each drawer.



Plastic drawers are 1/8" longer and 3/16" wider.

HANDIEST CABINET EVER BUILT FOR STORING SMALL ITEMS

No more frantic searching for misplaced items at home, shop, office or factory! EVERYBODY needs this convenient storage cabinet where small parts and supplies can be kept indexed, orderly, clean and easy-to-find. Your Jiffy Cabinet holds bolts, nuts, nails, screws, washers, drills, tools, repair parts, carbide tips, labels, radio parts, film . . . plus hundreds of other small, easily misplaced items! Attractive baked-on, silver-gray hammer-finish steel frame with rubber feet that won't mar any surface.

CLIP AND MAIL TO: HANDY PRODUCTS, P. O. BOX 2447, CLEVELAND 12, OHIO

PLEASE SEND IMMEDIATELY THE QUANTITY AND SIZE JIFFY UNIT LISTED BELOW

PLASTIC Drawer Cabinets	☐ 64 Drw. @$24.95*	☐ 48 Drw. @$20.95*	☐ 32 Drw. @$12.95*	☐ 24 Drw. @$10.95*	☐ 16 Drw. @$7.75*	☐ 12 Drw. @$5.95*	☐ 8 Drw. @$4.25*
METAL Drawer Cabinets	☐ 64 Drw. @$24.95*	☐ 48 Drw. @$19.95*	☐ 32 Drw. @$12.95*	☐ 24 Drw. @$9.95*	☐ 16 Drw. @$7.95*	☐ 12 Drw. @6.95*	☐ 8 Drw. @$4.95*

WE PAY ALL SHIPPING COSTS

NAME .....
STREET .....
CITY ..... ZONE ..... STATE .....
ORDERED BY ..... DEPT. .....

☐ Open Account, Purchase Order Enclosed.

☐ Check or Money Order Enclosed.

No. C.O.D.'s, Please.

*Ohio Customers Add 3% Sales Tax.

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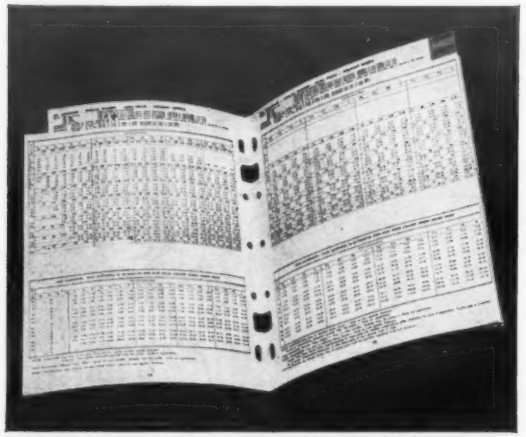
FIRST SIMPLIFIED PRICING IN GRINDING WHEEL HISTORY

CARBORUNDUM's New "Quick-Finding" Reference Replaces Traditional Complex Time-Wasting System



114 Page Pricing System Now Simplified to 32 Pages

CARBORUNDUM has achieved *simplification* with this new basic pricing system: previous information requiring 114 pages covering list prices, discounts, etc., has been reduced to only 32 pages.

You can now order your grinding wheels from CARBORUNDUM with a speed and accuracy hitherto impossible. Practically everything you want to know about prices, ordering quantities, discounts on any one wheel will be found on one page—arranged for quick, easy finding.

CARBORUNDUM® has taken the mystery out of buying industrial grinding wheels...by adopting the first really simplified basic price system in the history of the industry. Now you can determine prices, ordering quantities and discounts for a given wheel, almost without exception, by checking a single page of this new book.

You no longer have to refer to several pages to determine prices and discounts, nor follow complicated rules, nor apply chain discounts, nor worry about decimal multipliers. Even the special price additions covering various shapes have been eliminated. Basic prices are shown for all straight wheels *and* special wheels such as dishes, saucers, flaring cups, special faces, cones, plugs, and many others.

Practically all the wheels you use can be priced with a single discount under this new system, thus further simplifying your paper work and minimizing errors.

Coincidental with the adoption of this basic pricing system, some price adjustments have been made. Prices of certain lines of wheels are reduced, others are slightly higher.

"A Boon to Every Customer and To Us," is Distributor Concensus

First copies of this new pricing system off the press went to several hundred Industrial Distributors of CARBORUNDUM's grinding wheel lines. The many letters of response have been highly enthusiastic. Here are typical comments:

"This is, without a doubt, the finest simplified pricing system I have ever seen. We want to compliment you on this progressive step."

"Heartiest congratulations—the new net pricing schedules are swell! It would do your heart good to see the gratitude with which these prices were received by the boys in our organization. I feel that you men who devoted so much time to getting out this pricing structure should know how we feel. This is a real contribution to Industrial Distributors—and to industrial purchasing agents."

"Next to standardization of gradings, your new price book is probably the most progressive step that has been taken in simplifying the marketing of abrasives. With this new basic pricing plan practically all the complications have been removed. We know it will have enthusiastic reception."

"Carborundum has taken a forward step that should pay off in the future. After trying a few examples in pricing, it looks as though price clerks and purchasing people will have a much easier time arriving at net prices than heretofore."

The success of this new simplified pricing plan was foreordained, because twelve of the nation's top industrial supply men helped put the system together. This group, known as CARBORUNDUM's *Distributor Advisory Board, was of material assistance to* CARBORUNDUM's *sales management on this key project.*

HOW IT SAVES TIME...Cuts Errors

Reducing the number of pricing pages from 114 to 32 gives you only part of the picture of how CARBORUNDUM's new system speeds and simplifies the pricing of grinding wheels. It actually cuts down the number of steps required to compute a price—and best of all, it concentrates those steps within the confines of a single page.

As an example, consider the steps—and separate page references—previously required to find the price of cup wheels: 1) Look up the page showing the list price... 2) Look up the page showing list price additions... 3) Look up the page showing the standard ordering quantity schedule, to determine quantity for discounting purposes ...4) Look up the page showing product discount... 5) Look up the page showing quantity discount.

All this information, previously appearing in five different places in the price schedule, is now found on a single ready-reference page. No wonder pricing now takes far less time, with far fewer chances for error.

For when you have to flip pages back and forth, sometimes losing your place, often doing involved calculations, not only do you waste valuable time, but errors are bound to creep in—errors that are even more costly than the high cost of lost time. This new simplified "all-on-one-page" system was designed to be error-proof; thorough tests by grinding wheel users prove that it actually promotes a high degree of accuracy—thus makes doubly valuable the savings in time it gives you.

Simplified Pricing to be Extended to Other Abrasive Lines

The new basic pricing system will soon be applied to additional abrasive lines by CARBORUNDUM. Segments, Disc Wheels, Mounted Wheels and Points, "MX" Wheels, and other bonded products will shortly be covered by new simplified basic price lists.

THE CARBORUNDUM COMPANY

REGISTERED TRADE MARK

Your copy is waiting for you...

MAIL COUPON NOW...TODAY!

THE CARBORUNDUM COMPANY, Dept. TP 81-317
Niagara Falls, New York

Please send me my copy of "New Simplified Basic Prices of Grinding Wheels."

NAME

COMPANY

STREET AND NUMBER

CITY ZONE STATE

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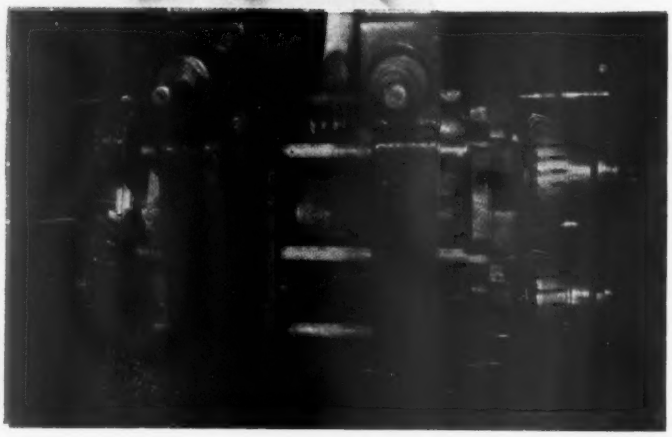
THERE IS NOTHING HARDER THAN A DIAMOND but WESSONMETAL IS TOUGHER!



ACTUAL JOB
Large Automobile Plant

Machine.....Davis Thompson Milling Machine
Part.....Rear axle shaft
Operation....Rough and finish mill spline end
Material.....S.A.E. 1038—Brinell Hardness 179-229
Tools.....Wesson 6" and 8" dia. Milling Cutters—fine pitch—inserted blade
Speed.....8"—387 S.F.M.
6"—290 S.F.M.
Feed.....14" per minute
Production...150 pcs. per hour
1500-1700 pcs. per grind
Grade of Carbide....Wessonmetal WM

SAVINGS OF OVER $14,225 PER YEAR ON ONE MACHINE WITH ONE SET OF WESSON TOOLS

OLD METHOD		NEW WESSON ENGINEERED METHOD	
Cost 1 set Inserted Blades	$48.00	Cost 1 set Inserted Blades	$54.60
Pieces per Grind	275	Pieces per Grind	1600
Grinding Hours per year	10,300	Grinding Hours per year	2500
5 Machines Running 3 Shifts		3 Machines Running 2 Shifts	
Machine Repair per year	$25,000	Machine Repair per year	$1200
Tool Cost per Piece	$.00545*	Tool Cost per Piece	$.00213*

*(Machine repair and grinding costs not included)

HOW IS YOUR PRODUCTION SCORE CARD!

Write today for folder on Wesson's educational, full color, sound movie — "This Carbide Age."

Call Your
WESSON SERVICE ENGINEER—

WESSONMETAL Cemented Carbide

WESSON METAL CORPORATION
LEXINGTON, KENTUCKY
Affiliated with WESSON COMPANY, Detroit, Mich.

HARDINGE ELMIRA, N.Y. Collets for Lathes and Milling Machines

for **ACCURACY**
DURABILITY
ATTRACTIVE PRICE
STOCK DELIVERY

Specify **HARDINGE** *Collets*

A useful reference list for Purchasing and Engineering departments. Helpful ordering information and up-to-date listing of popular style collets for all makes of lathes and millers. Shows major dimensions; maximum capacity for round, square and hexagon; collet adaptations for nose type chucks; stocking locations; how to order and prices.

WRITE NOW!
If you do not have a copy of Bulletin No. 50

HARDINGE BROTHERS, INC., ELMIRA, N. Y.
"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

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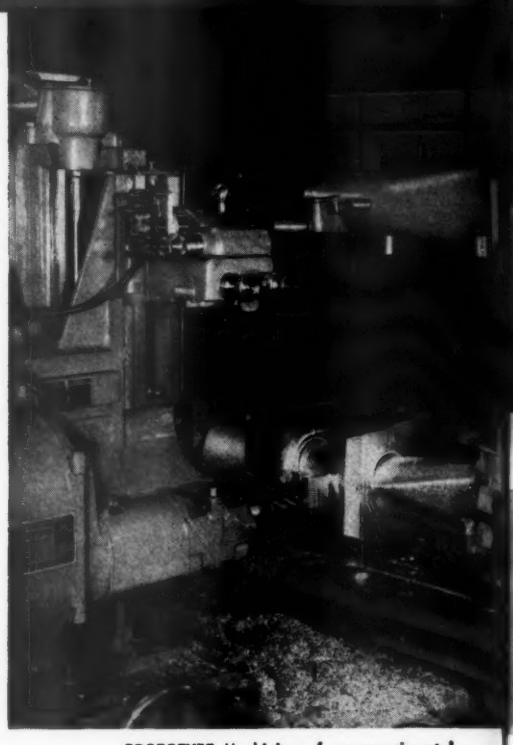
SO MANY JOBS done...s

ON A PRATT & WHITNEY TYPE BL KELLER MACHINE because



PROTOTYPE Machining of an experimental aircraft part from a solid billet

"KELLERING" REPRODUCES COMPLEX, IRREGULAR SHAPES FASTER, MORE ECONOMICALLY . . . "KELLERING" — automatic tracer-controlled milling — easily handles irregular and complex shapes that otherwise would be difficult to machine by any other conventional method. The initial job is done economically, and additional duplicates can be produced at a fraction of the usual time and cost.

KELLERS ARE DESIGNED AND BUILT *SPECIFICALLY* FOR TRACER-CONTROLLED MILLING . . . not just "adapted." Complete, versatile, powerful and provided with a wide range of spindle speeds, they're ready to take on an unlimited variety of jobs without needing major adaptation by expensive attachments.

THEY'RE RUGGED, DEPENDABLE, STAY ON-THE-JOB . . . year after year without frequent or expensive maintenance.

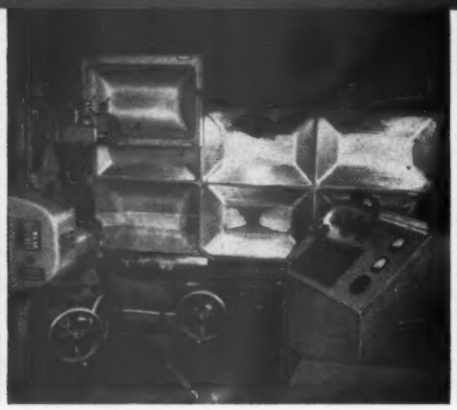
HORIZONTAL CONSTRUCTION PROVIDES MAXIMUM STRENGTH, RIGIDITY, EFFICIENCY and CONVENIENCE . . . workholding and positioning are simplified, and the open side construction places no limitation on the size of the work piece. Chips and coolant fall out of the work cavity, cutting is fast and free, without clogging. Operator always has a complete view of cutter and work. Full push button operation is centralized on a single control panel.

ELECTRIC TRACER CONTROL . . . is dependable, relatively simple and retains its high initial accuracy without frequent maintenance or complicated adjustment. Master forms are duplicated PRECISELY. Machine uses two types of tracer control: ***Profiling*** to a pre-set depth following an outline template; and ***3-Dimensional Milling*** using an inexpensive model as a master.

KELLER TYPE BL IS A VERSATILE, HANDY SIZE MACHINE — JUST RIGHT FOR MANY AVERAGE JOBS IN YOUR SHOP . . . two standard sizes are available, 24" x 16" and 36" x 20" — both with 8" transverse travel. Both can be furnished as Three-Spindle Machines with 8" or 10" center distances between spindles.

..so EASILY...and so WELL

PLASTIC MOLD, intricate 3-dimensional milling from a plaster model



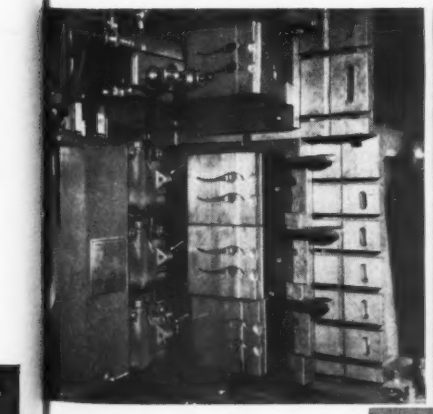
RUBBER MOLDS, six from a single master, for foam rubber pillows

INDEX PROFILING, machining five cavities requires only a single master

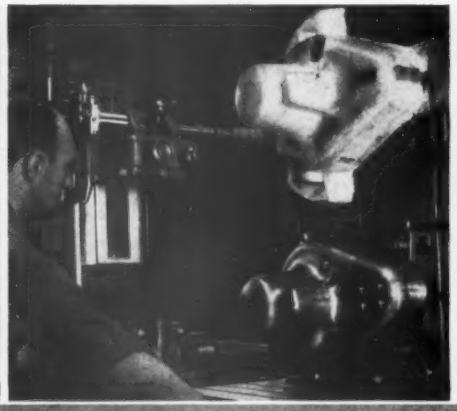
BY TRACER-CONTROLLED MILLING

PLASTIC MOLDS • RUBBER MOLDS • FORGING DIES • METAL FORMING and DRAWING DIES
DIE CASTING DIES • METAL PATTERNS • CAMS • PROTOTYPE WORK • PRODUCTION MILLING
and MANY OTHER JOBS WHERE IRREGULAR SHAPES MUST BE MACHINED

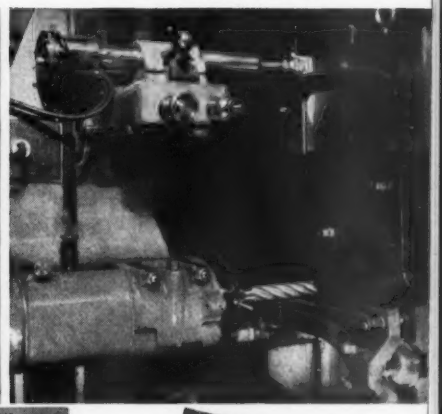
3 FORGING DIES machined simultaneously on a 3-Spindle Keller



DIE CASTING DIE for a power lawn mower motor housing



PRODUCTION MILLING, profiling an aircraft landing gear component



FOR COMPLETE INFORMATION, write us for P&W Circular No. 490-3 fully describing the Type BL Keller Machine.

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WEST HARTFORD 1, CONNECTICUT, U. S. A.

Circular No. 490-3

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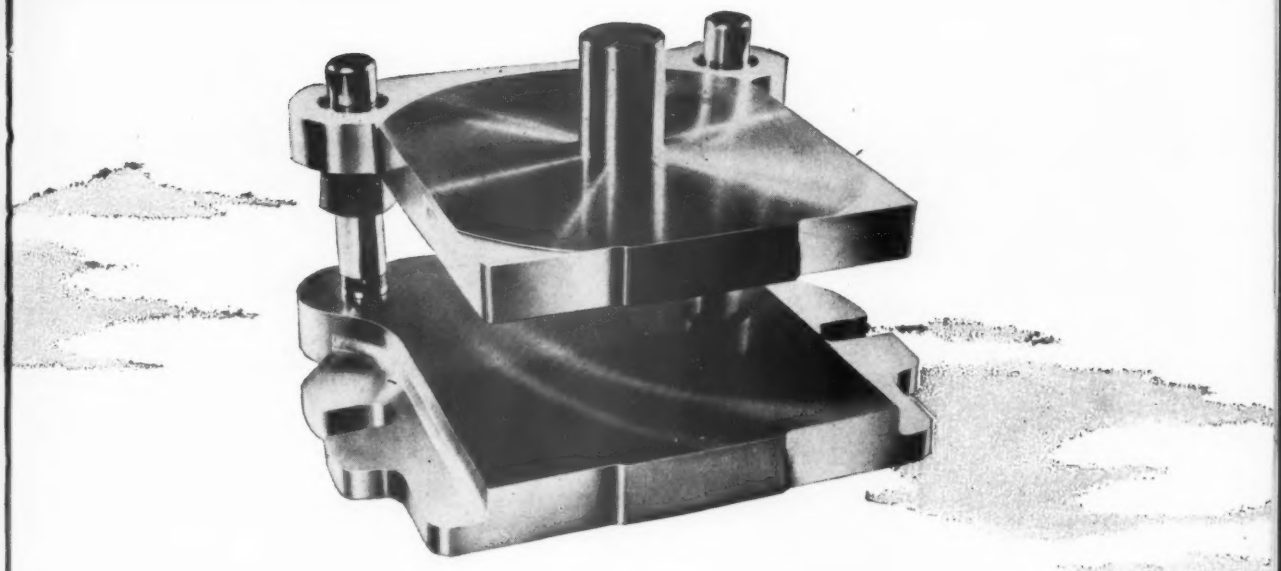

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help build the mighty Cat Diesel Tractor

You can trace the mountain-moving brawn of the famous Cat-built Tractors right back to the production line . . . and to Danly Die Sets. Caterpillar Tractor Co. uses Danly Die Sets as a precision base for many diemaking operations . . . depends on them to help maintain uninterrupted production schedules. Danly Die Sets save countless hours in the die shop . . . make tooling-up much faster – easier too. Why not bring Danly Die Sets into your production picture? . . . get the kind of die performance you're looking for. Remember – there's a Danly Branch near you. Service is fast . . . convenient.

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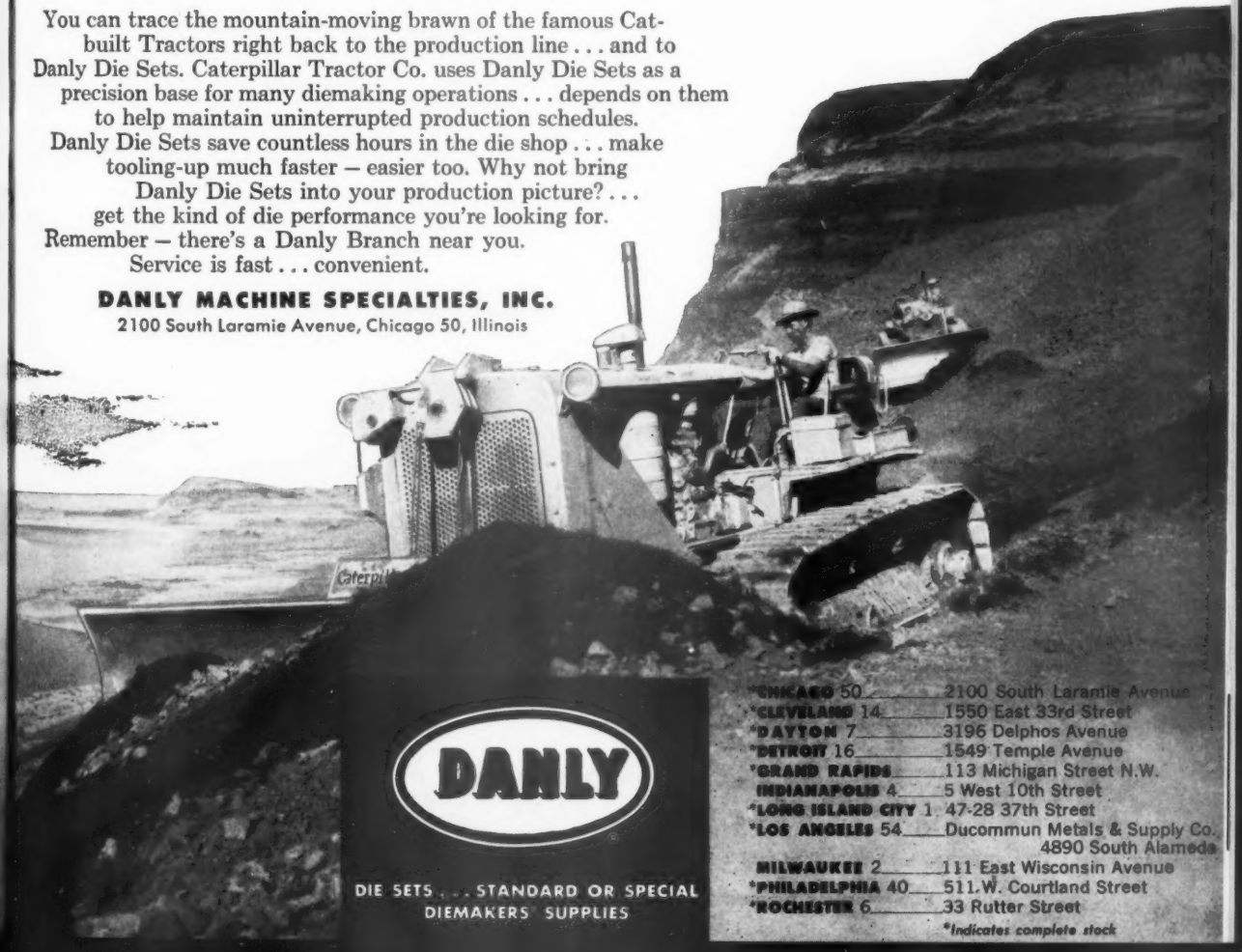

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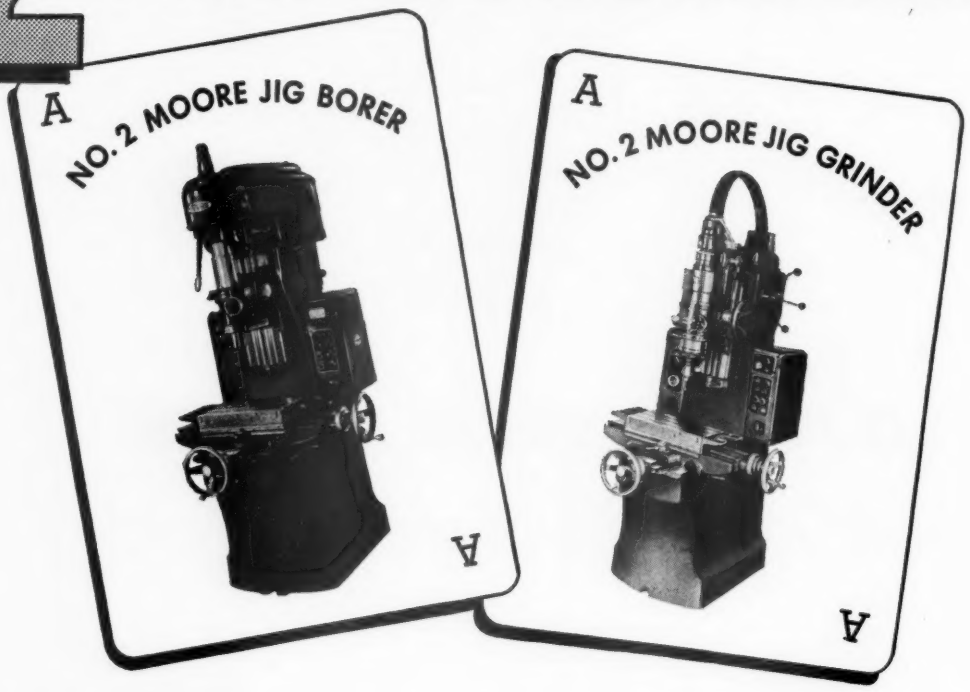
2 New Toolroom Aces



Jig Borer of the Carbide Era—For boring, drilling, reaming and spotting holes in dies, jigs and production parts, the speed and accuracy of the Moore Jig Borer cannot be equaled. More than 1,100 users of the No. 1 model will verify that. Now with this larger No. 2 model specially engineered for the Carbide Era, holes from .0135″ (or smaller) up to 7″ can be accurately located and produced in a fraction of the time required by other means. Hardened, ground and lapped lead screws, permitting table settings within .0001″ by coordinate location, eliminate the need for end measures—reduce set-up time! Sensitive, centralized controls for spindle speeds and feeds, quick tool-changing and easy lubrication add up to more time and effort saved—more accurate work produced.

Jig Grinder of the Fifties—The originators of the Jig Grinder have done it again! With this completely new and larger Moore Jig Grinder, *regular and irregular contours* are ground to size and location after hardening. This extends the Jig Grinder's traditional function of relocating straight and tapered holes. The same quickly set precision lead screws, as in the Moore Jig Borer, simplify the finish-grinding process. Holes from $\frac{1}{64}$″ to 8″ can be relocated and ground within .0001″—by power or hand feed. The infinitely variable spindle speeds, up and down feeds, and special stops and scales built into the machine, permit fast, accurate grinding of contours. Complete punches and dies can be ground to figures, with no stoning or fitting required for perfect alignment of mating parts.

LEARN MORE ABOUT JIG BORING AND JIG GRINDING THE MOORE WAY

Descriptive literature, fully illustrated, is available on both the Jig Borer and Jig Grinder. We will be glad to send you copies and answer any specific questions you may have about hole location practices.

Moore Special Tool Company, Inc., 726 Union Avenue, Bridgeport 7, Connecticut

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Whether you have a tough cutting tool problem or just an ordinary "special" why not find out how Spiral can give you maximum tolerance control . . . and longer tool life with a Spiral Tool especially designed to simplify a given operation or to combine several operations into one.

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For a quick answer to your specific cutting tool problems, send complete details, including tool, part print and specifications. Write for a free copy of latest bulletin showing other examples of SPIRAL time-saving tools.

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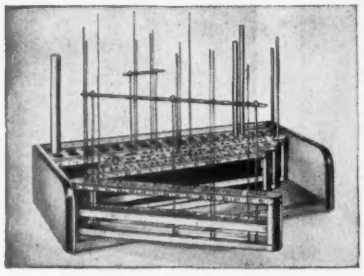
inexpensive

. . . Money Saving Accessories For Your Plant

Each of the accessories illustrated and described below was designed and built for a definite need and used in our own plant before being offered to industry. They require a relatively small investment, yet will save you money every day. For further information, write for the folder offered below.

DRILL ROD RACK

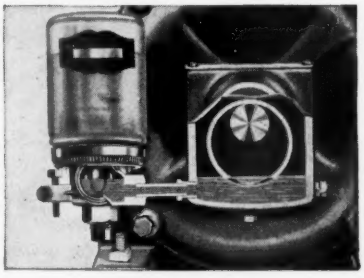


Eliminate trouble and waste effort with this modern method of storing drill rod. Put the Acro rack in a central location of each department and make it simple for each mechanic to select correct rod size in a hurry. It also provides a visual inventory for checking rod replacements.
Accommodates 26 letter sizes, 52 pieces; 47 fractional sizes, 138 pieces; 60 number sizes, 304 pieces. Fractional sizes graduated in 64ths from 1/32" to ½" and in 32nds from ½" to 1" included.

LEADER PIN OILERS

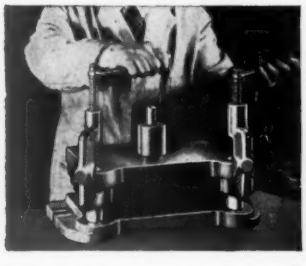
Eliminate wear on your die sets with these leader pin oilers. Acro Pin Oilers, as illustrated, fit over each leader pin and seals in place with a rubber neoprene washer. Each cup is filled with oil so each downward stroke brings bushing in contact with oil and each upward stroke distributes oil evenly over leader pins. Eliminate bushing wear, leader pin scoring, and maintains die accuracy. Die sets equipped with Acro Pin Oilers have run under tests for several weeks to a month without refilling.

AUTOMATIC LUBRICATORS



With this Acro lubricator, you can lubricate oil ring, capillary, ball or roller bearings on electric motors, blowers, lineshafts and similar bearings for periods as long as six months to one year with one filling. You can save 50 to 95 per cent in oil consumption, practically eliminate maintenance labor and burned out bearings due to faulty hand oiling and guesswork. In addition to savings effected in labor and maintenance, Acro lubricators soon pay for themselves in oil savings alone.

DIE SET PULLERS



The principle of the Acro Die Set Puller is to remove the punch holder from the die shoe by a straight upward pull, whereby punch holder travels upward from die shoe axially, leaving both leader pins simultaneously. This is accomplished only by use of the indexed screw wrenches which act as indicators, controlling the upward travel. This is an exclusive patented Acro feature, found only in Acro Die Set Pullers.

Free Data

covering each of these profitable accessories is included in our folder. Write for bulletin TP-52.

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MICROBORE
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FOR PRECISION BORING

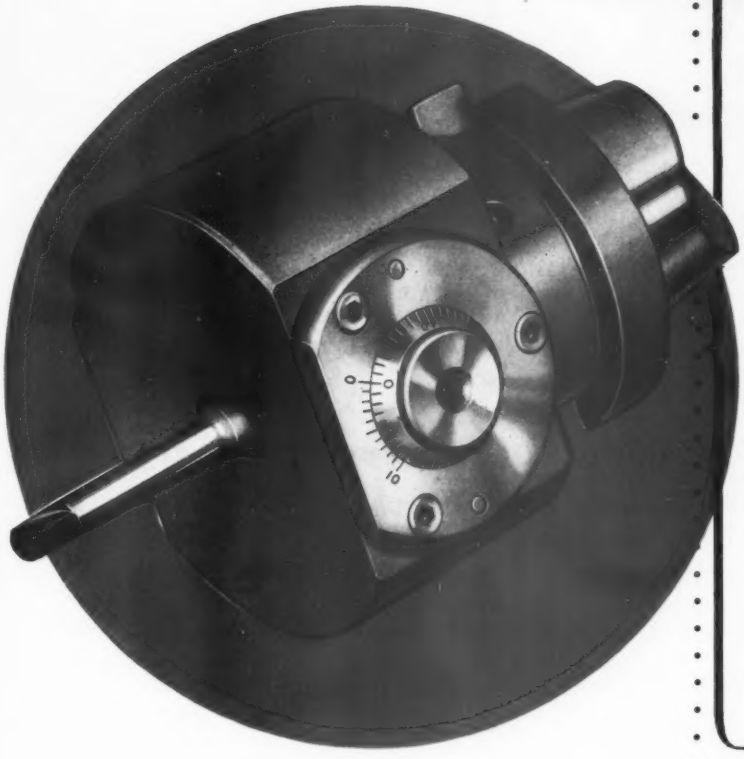

Illustration at right shows boring head with standard set of boring tools mounted in a fitted hardwood case.

The NEW MICROBORE MB-121 ADJUSTABLE BORING HEAD

This Boring Head is adjusted rapidly and accurately by means of proven Micrometer Vernier principle. The tool slide can be adjusted in accurate increments from zero to ¼" off center. The boring head can be furnished with straight, taper, or flanged type shanks to suit any make of boring machine. With a standard set of boring tools, bores ranging from ¼" to 1" diameter can be machined.

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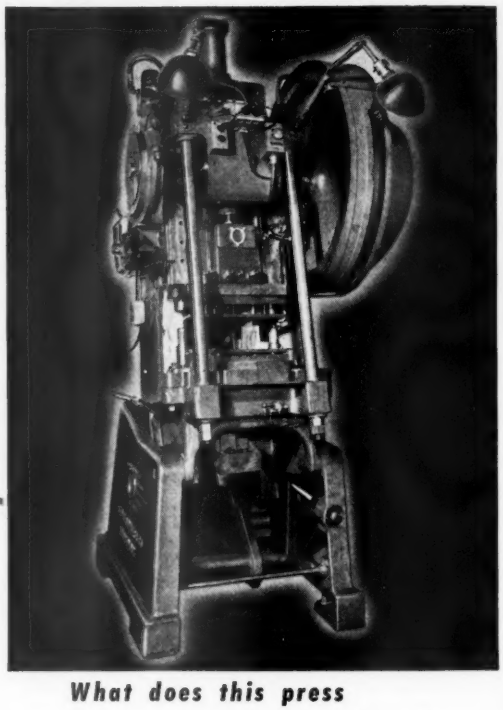
WHAT R-B PUNCHES SAVE...



What does this press cost you per hour?

If you use shoulder or set-screw type punches, you have excessive press down-time when replacing worn or broken punches.

But, with R-B interchangeable and standardized punches and die buttons you get quick insertion and removal in the press. The R-B ball lock features, that assure positive radial alignment and vertical locking without further keying, permit greater press utilization.

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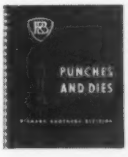

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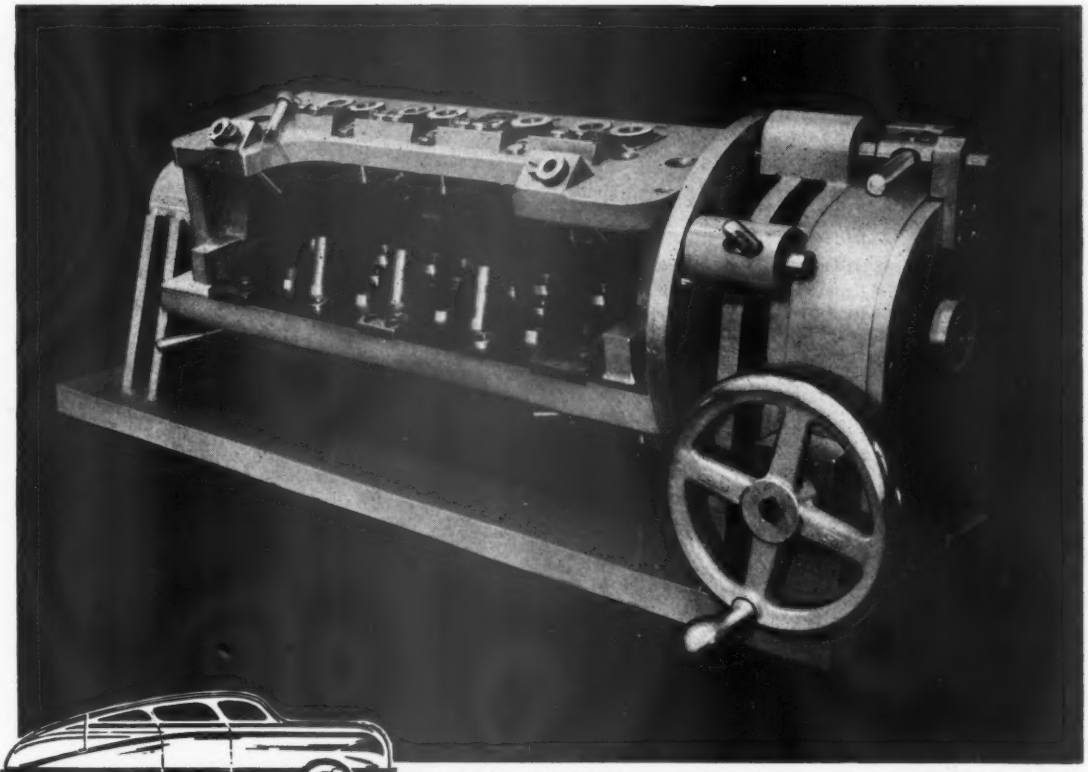

Built by Barth for a prominent car manufacturer

ASSURES PERFECTION of CYLINDER HEADS!

THE HIGH DEGREE of mechanical perfection achieved in this famous (name on request) automobile is due in great part to almost microscopic checking of every part and component that goes into the powerful engine.

As an example, the Barth fixture illustrated was designed to assure the perfection of all operations performed on the cylinder heads coming off the regular machining line . . . any valve guide holes, bolt holes, tappet holes, etc., that may have been missed or proven faulty in the original drilling are caught and corrected with this Barth fixture.

Here again is evidence of the wide scope of the Barth organization in building tools, dies, gauges, fixtures and special machinery for any industrial need. *Write for the Barth Catalogue.*

BARTH STAMPING & MACHINE WORKS Inc.
12650 Brookpark Road, Cleveland 29, Ohio

DESIGNERS AND BUILDERS OF DIES, TOOLS AND SPECIAL MACHINERY

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Machine Tool Design Changes for Automation • Index Press Tooling • Blanking Die Designs and Applications • Inspection Setups for Roller Bearings and Races • Deep Drawing Rectangular Shapes • Optical Microscopy for the Inspector • Press Workability of Lurium

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message for engineering students **39**

Belt Grinders

"Abrasive Belt Grinding of Buckets and Blades" **41**

A new generating belt grinder using an abrasive belt traveling between a master form and the workpiece constitutes an improved method of grinding buckets and blades for aircraft gas turbines.

Single Spindle Automatic

"Machining on the Single Spindle Automatic" Part II, by Lester F. Spencer, Landers Frary & Clark **43**

In this second installment Mr. Spencer continues his recommendations for tooling single spindle automatics with particular attention to external threading.

Turret Lathes

"Controlling Length of Cut to 0.0001" Tolerance on Turret Lathes" by Louis H. Fike, Straehle Machine Products ... **48**

Mr. Fike describes the application and operation of a turret lathe attachment designed for controlling the length of cut on workpieces to close tolerances.

Industrial Brushes

"Power Brushing—Factors in the Selection of Brushes" by R. O. Peterson, The Osborn Manufacturing Company ... **50**

Each brushing job has its own characteristics, and each should be studied by someone familiar with brushing techniques so that the proper brush can be selected for any specific job.

Welding

"Automatic Arc Welder Joins Dual Exhaust Pipes to Flange" by Herbert Chase **54**

Automatically welding two exhaust pipes into the hole of a common attaching flange solved one production problem on the new Buick V-8 engine.

Ultrasonic Machining

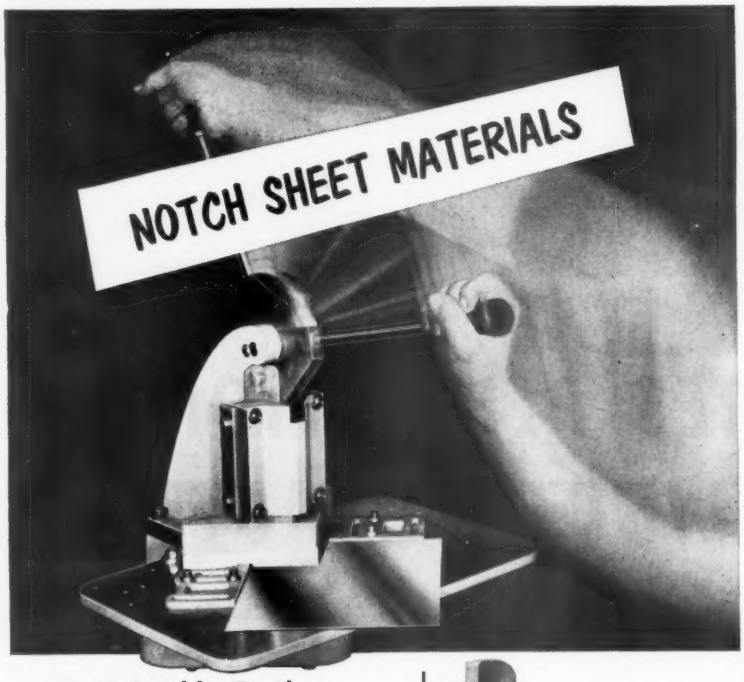
"Ultrasonic Machining of Carbide and Other Hard Materials" **56**

Mechanical vibrations, acting through a cutting medium of fine abrasive particles, are now employed in carbide machining.

Metal Treatment

"Low Temperature Treatment of Metals" **72**

Mechanical refrigeration now makes possible the application of low temperatures to metals. The advantages of this treatment are comprehensively presented.



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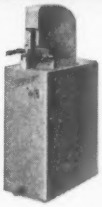
Speed up notching operations, eliminate the need for heavy presses and dies. A 6″ x 6″ notch is made in 16 guage material in one operation. Also perform many straight shearing jobs.

*Pronounced DIE-ACK-RO



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Especially designed for operations where a high rate of production must be maintained. Motor driven flywheel and all moving parts housed in a welded, steel cabinet.

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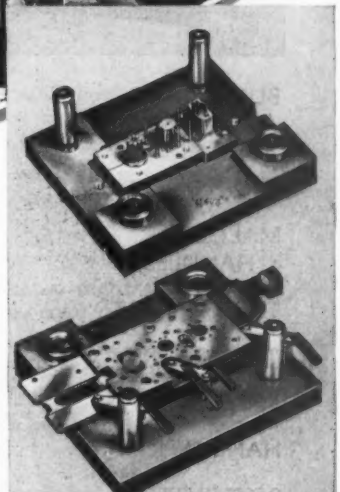
Look—a pictorial selection of today's newest literature. Reach up on the rack—take your pic.

"PROGRESS ON PARADE" 129
Check this carefully. It can bring new efficiency to your operation. The newest in machines, tools, and accessories.

THE HOUSE OF HARIG

America's Foremost Producer of PRECISION DIES



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Leading manufacturers faced with the increasing demands of modern production—specify Harig tools and dies. Based on experience, they know that to specify "Harig" means to specify the finest in precision, quality and performance that can be embodied in a fine tool or die. Let Harig show you how die quality means greater die economy.

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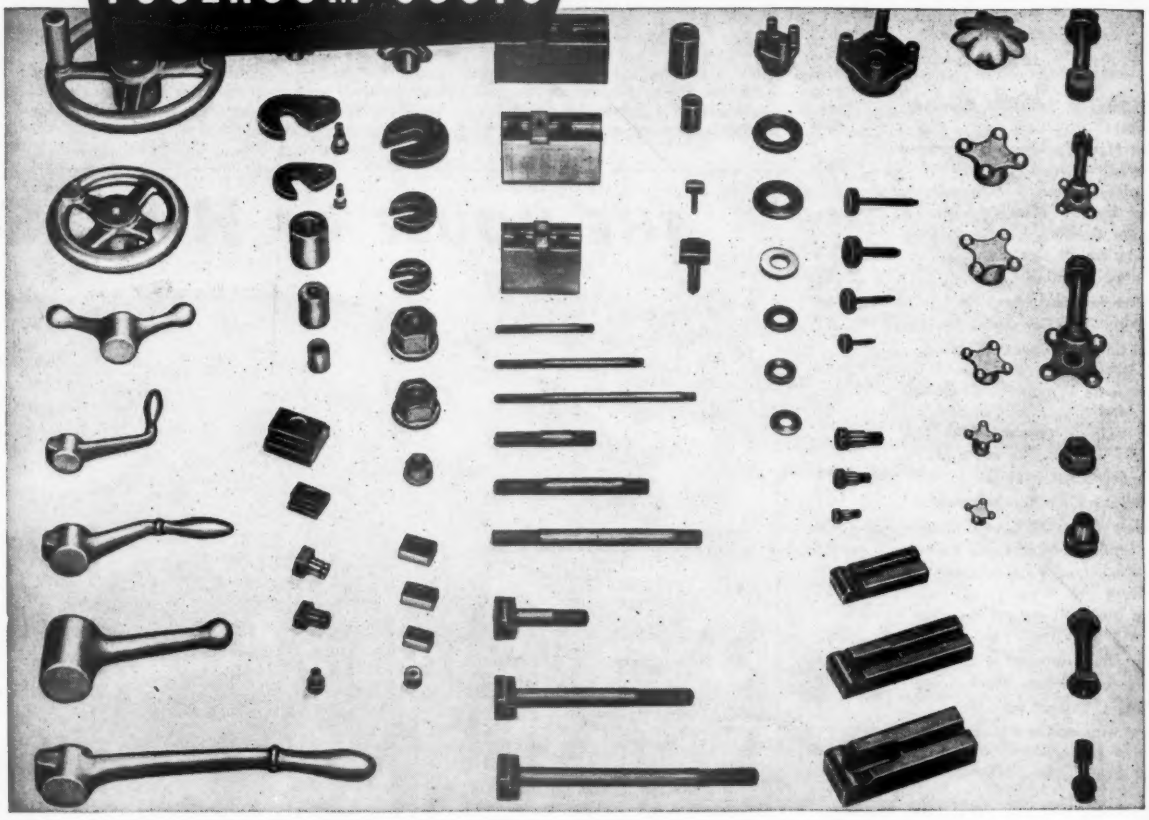

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THUMB SCREWS
TEE SLOT NUTS
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editorial

a message for engineering students

As this is written we are beginning to hear, in increasing volume, the sound of marching feet. From a massed bank of chairs comes, one by one, exalted college seniors. At a mid-point across the platform they are handed a piece of paper—their diploma—and as they resume their seats they revert to freshman status; rank, tyro, neophyte freshmen in the world of commerce, industry, and the professions.

Obviously, because of the field of endeavor served by TOOLING and PRODUCTION, we are extremely interested in today's engineering student. We would like to reach him through you who (1) have sons in or just out of engineering training, or (2) who have friends, neighbors or relatives with sons engaged in acquiring an engineering education, and (3) through those of you who are associated with engineering training and instruction in any way, be it in-plant training under your supervision or local trade school, and from where may come your future engineers.

We would like to be able, through you, to present each and every such student with a copy of a talk given a few days ago by an eminent Detroit engineer to the University of Michigan chapter of Tau Beta Pi, the national honorary engineering fraternity.

Although the members of this group represented many different ages and ranged in professional accomplishment from undergraduates to members of considerable and distinguished achievement in years of active engineering work, the speaker chose wisely to direct his remarks "toward the younger people here who will soon be moving from academic activities into more direct applications of their learning".

His talk was far too comprehensive and important to attempt briefing within the confines of this page. Suffice to say, he points up in a most forceful and authoritative manner, the new world of engineering which the new student engineer must prepare himself to conquer. He presents a formula, evolved by an engineer and for engineers, whereby the younger engineer can avoid many unsuspected pitfalls.

For instance, "it does not impress me if the introverted, uncommunicative engineer is so learned that he can prove that water can be frozen in hell. I say that he will not be comfortable in the social hell of his own making, even if he can air-condition it. It will always be a hell he made for himself if he never learns to get along with other people". And being a forthright, practicing engineer, the speaker proceeds to blue-print a simple pattern for getting along with people.

He also demonstrates a sympathetic awareness of the abnormal supply and demand situation currently confronting the young engineering aspirant, i.e., more jobs than takers. He warns, "Let me assure you that these who flatter you now, to obtain your services, would flatter anyone else in your position to obtain his.

"Do not fail to see this cardinal point. You are eagerly sought by those who need engineering ability in their organizations. But you are not sought for what you are now. You are wanted for what they expect you to become later on. That is the nub . . . What you may become later on.

"The search is for talent that can be developed. It is for engineers who can grow into responsibility. It is for engineers who can be more than just engineers. It is for engineers who can lead men, direct men, persuade men and inspire the confidence of men.

"You will not discover how to become that kind of engineer in your engineering textbooks!"

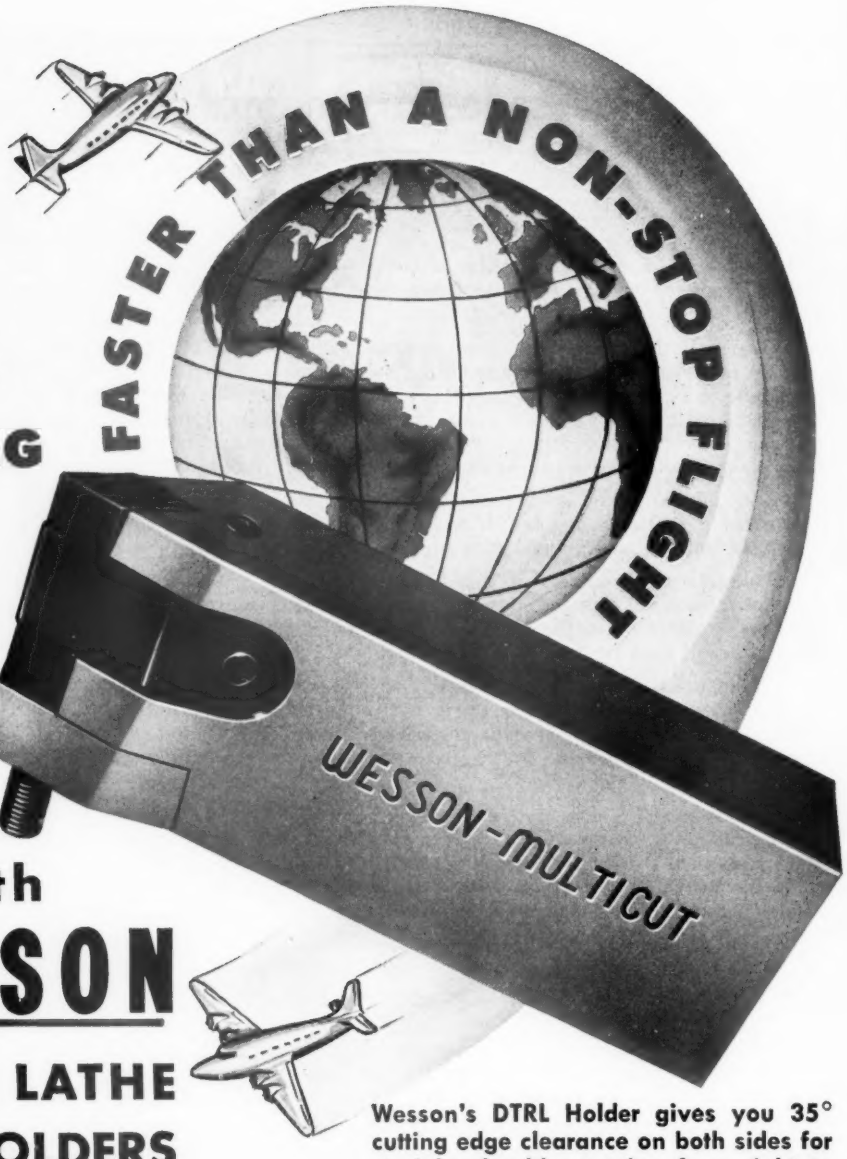
Profound engineering textbooks are available to all — college undergraduates, night school students, correspondence school students, apprentices, regardless of "race, creed or color". The only tuition cost of a textbook education is a library card.

What today's engineering student needs most are such thoughts, guidance and inspiration as are not found in texts but which are built into this automotive engineer's message.

If you know one engineering student or trainee or one hundred, ask us for one copy or one hundred. We will delight in enabling you to perform a real service.

E. Willard Pennington

editor



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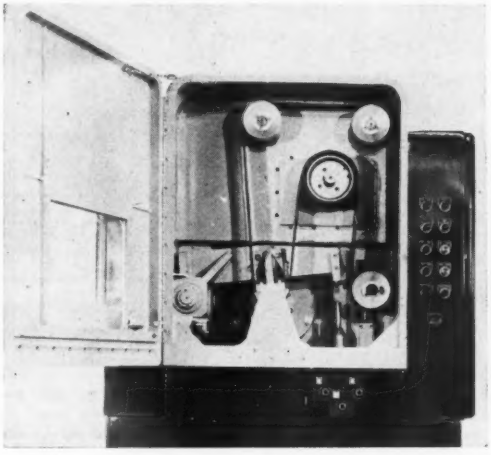
ABRASIVE BELT GRINDING OF BUCKETS AND BLADES

A NEW METHOD OF GRINDING BUCKETS AND blades for aircraft gas turbines has been developed by Planet Products Corporation of Cincinnati, Ohio in their new Generating Belt Grinder. Planet, in cooperation with Metcut Research Associates, also of Cincinnati, designed and built the first developmental grinders for the metal working department of one of the country's largest aircraft builders.

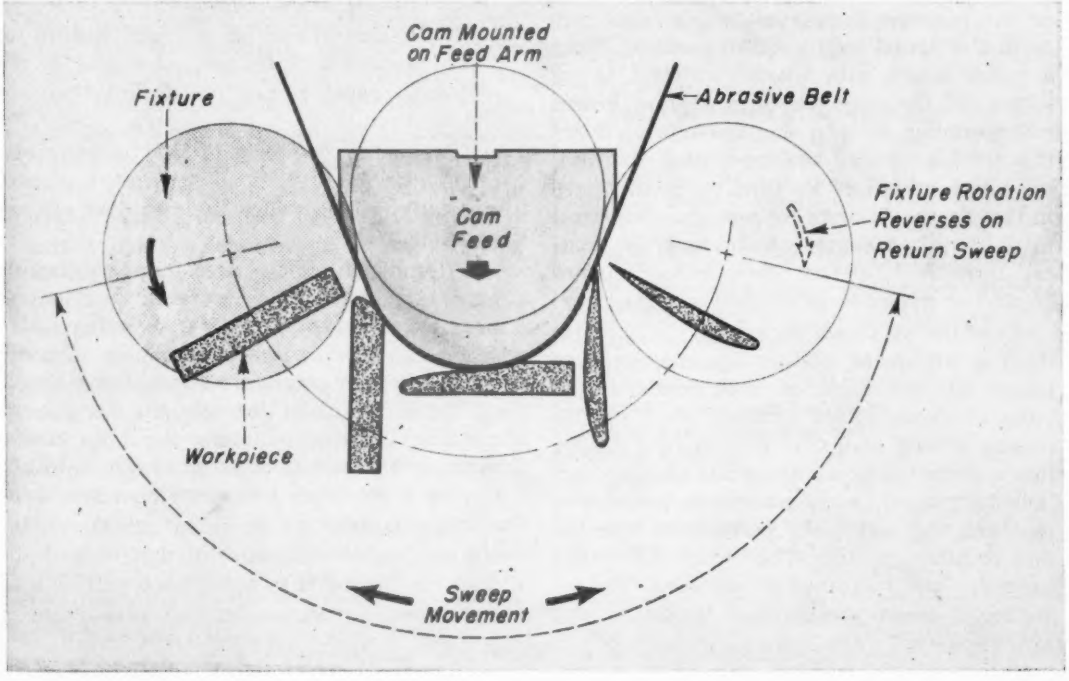
The machines, tooled for "Sapphire" turbine rotor and stator parts, have removed stock from one side of blades at a rate of .001" to .003" per second, so that an average cycle time of less than one minute per side can easily be obtained with usual stock allowance. An 80-grit belt has been used on the rough or "semi-precision" Nimonic (about 80% Nickel) forgings to produce approximately a 50 microinch finish. Depending on material and stock-removal requirements, tests have indicated that almost any degree of finish can be obtained.

Design of the machines incorporates a new approach to conjugate form grinding, using an abrasive belt traveling between a master



(Above) Interior of grinding unit showing belt path. Motor pulley drives on abrasive side of belt which permits back of belt to be lubricated. Feed unit mounted under grinding box has three adjustments (indicated by counters) for slow feed, total feed and final size. Drawer to left of feed box is a trap to keep bulk of chips and sludge from entering coolant tank.

(Below) This drawing shows the basic motion and belt path for generating a simple airfoil shape. The center circle represents a gear mounted in fixed position on the axis of the sweep arm. The outer circles represent the planet gear at its extreme positions at opposite ends of the sweep motion. Stock is actually removed at a sweep rate of about one cycle per second.



Exterior appearance of the generating belt grinder gives evidence of unit construction. Plastic sliding door and shelf below makes it easy to load and unload workpieces.

form and the workpiece.

The master form generates the desired contour as a result of the specific relative motion between it and the workpiece. This motion is such that progressive contact of limited area results. Under these conditions, a 15 hp motor supplies ample power for rapid metal removal.

The shape of the master form for each job is determined right on the grinder. A master blade or bucket is placed in position on the machine, supported in the same way as in the actual engine when possible. Then a blank faced with plastic material is inserted into the conjugate form position. Power sweep motion is then employed in conjunction with hand feed control so that the master blade generates its own conjugate form in the plastic. After being reproduced in steel to the required degree of accuracy, the master form is hardened; then either surface treated or plated to improve wear resistance.

Once the machines are set up, the operator loads a workpiece, presses the master cycle button and the operation is automatic to the point of removing the finished piece and inserting a new one. One part can be loaded into a cartridge or shuttle while another part is being ground in cases where it is desirable to check the workpiece position or size before or after grinding. The work-holding fixtures are easily cleaned or replaced. The sequence of events and motions is positive and independently adjustable where desirable. The variety of adjustments necessary, such as feed rate, distance of travel, grinding force, etc., are adjustable in the most functional sense.

The following cycle illustrates: rapid approach to an adjustable point . . . rapid feed to remove high points on the workpiece . . . slow feed for another adjustable distance for the bulk of stock removal . . . adjustable tarry time to insure proper spark out . . . rapid return. (Feed rates are, of course, also adjustable)

The Planet method makes possible the rapid removal of sufficient stock to produce the required contours from comparatively rough work pieces, thus eliminating the need for expensive high-precision forgings or castings. An additional advantage is the elimination of the objectionable skin effects that are encountered on some forgings and castings. Machines now in production incorporate many refinements in design, developed through extensive testing and research utilizing developmental machines.

There are two basic models. One is for concave shapes, and the other grinds convex and relatively flat surfaces. It is possible on some of the comparatively flat blades (many compressor blades, for example) to grind one side of the blade and one-half of the leading and trailing edges in one setting. A blade of this type can be ground complete (except for root contours) in two handlings.

Unit construction is another feature of these machines. The base, electrical panel, hydraulic panel and grinding unit comprise the basic units.

The common problem of heat in hydraulic circuits has been eliminated. Pressure is automatically reduced when the machines are not grinding.

A sandwich plate is used for the hydraulic panel on which all hydraulic valves are mounted (except the pilot reversing valve which is near the sweep assembly). This design makes for minimum number and length of hydraulic lines. Virtually all components used are Vickers, including the 2 hp motor-pump unit mounted adjacent to the hydraulic compartment for easy access and maintenance.

Push buttons are mounted directly on the electrical panel enclosure at the front of the machine; wiring is in accordance with J. I. C. standards.

Part II

MACHINING ON THE SINGLE SPINDLE AUTOMATIC

Threading — External threading tools for automatic screw machines may be classified into two general types, the solid and the self opening types. The solid type of thread chaser, as exemplified by the acorn dies, must be backed off the work after the required number of threads have been cut.

by Lester F. Spencer
Chief Metallurgist
LANDERS FRARY & CLARK
New Britain, Conn.

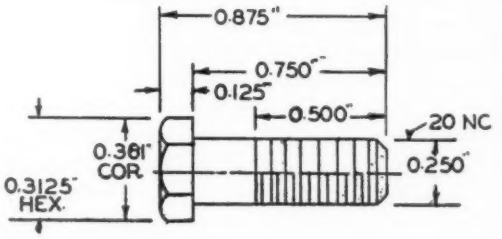
The self opening die head, of which there are a number of designs available, opens after the piece is threaded; the tool clearing the work, which precludes that no changes in spindle speed are necessary. The self opening die heads are usually used for larger sizes of work and for jobs where the threading time may be the controlling factor.

The hexagon head screw, as illustrated in Figure 6, is produced in 20 seconds; four turret positions and both cross slide positions being employed. This job not only illustrates threading operation with a button die, but also the previously discussed operations of box tool turning, circular forming and cut-off. In addition, it has a pointing operation which has not been discussed. The button die is supported in a non-releasing die holder; the rake angles employed varying from 10° to 25°. Thus, the larger values are used on steel, whereas the smaller values of rake serve adequately for brass. Hook grinds can also be employed on very difficult materials. In general, it can be stated that[2]: — (a) there is probably too little hook if the die drags and either tears the thread or tends to load with chips; and, (b) there is too much hook if the tips of the cutting thread break off or round over quickly.

Part One of this Two Part article appeared in the May, 1953 issue of TOOLING and PRODUCTION, page 42.

HEX HEAD SCREW—

Material—C.R.S. 5/16" Hex.
Seconds to make One Piece—20
Gross Production per Hour—180
Equipment—No. 00GHS Brown & Sharpe Automatic Screw Machine



Spindle R.P.M. 260 1270 Rev.	Order of Operations and Tools	Feed per Rev.	Sur. Ft. per min. of Stock
13	Index Turret		
135	Turn #00 EB Box Tool (Left Hand)	0.0055	120
13	Index Turret Reverse Spindle		
13 13	Thread #00 H Die Holder (Button Die)		16
13	Index Turret		
21	Point #00 AA Pointing Tool. Circular	0.001	80
	Form Front Slide	0.002	120
140	Cut Off Back Slide. Index Turret 3 Times	0.001 0.0015	120
13	Feed to Stop		
423			

List of Tools

1—00FA Box Tool
1—00H Die Holder
H.S.S. Button Die—¼-20 N.C.
1—00AA Circular Point Tool Holder
1—H.S.S. L.H. Circular Point Tool
1—H.S.S. Form Tool
1—H.S.S. Cut-off
1—Stop—1 and ¾ Long
1—#10 Spring Collet—5/16 Hex.
1—#10 Feeding Fingers—5/16 Hex.

Figure 6

The first two threads in a button die are cut or chamfered; this being done to spread the cutting burden over several teeth. When the die is backed off the screw, there are left two incomplete or shallow depth threads which represent the farthest advance of the die. For this particular screw, two partially formed threads are not objectionable, and the two thread chamfer is satisfactory. However, for parts that are to be threaded close to the shoulder, either the one thread or part of a thread chamfer is required.

Most dies are chamfered at both ends; the short abrupt chamfer end faces the stock when threading to a shoulder. The other end has a long chamfer and should be used on all jobs where two incomplete threads can be tolerated. In general, better cutting and longer life is realized when long chamfer dies are used. As is true for all threading die design, balanced cutting edges is imperative. Thus, unequal grinding, which results in one jaw doing all the cutting, will place a severe strain on the die and will produce a poor or rough thread. Unequal grinding of die can be readily seen by the difference in chips.

Brief mention can be made of the pointing tool operation, as it is applied in this job sequence and illustrated in Figure 8. It is very similar to a circular form tool in principle, however it is supported in the turret. In this instance, the tool has an angular cutting edge to point or chamfer the end of the screw; a 3/32" drop below center to maintain the intended form on the work. No hook or rake is placed on the tool. The purpose of the form tool is to give a square

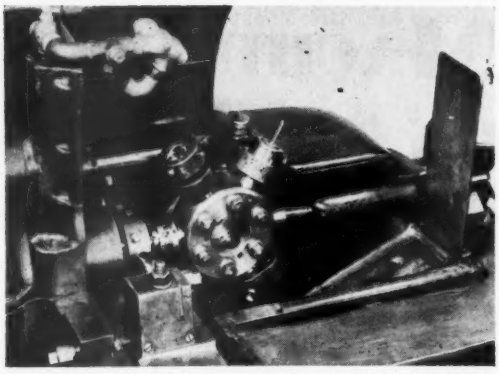


Fig. 7. A die holder is shown set-up in one of the turret stations.

finished shoulder and to remove any burr left at the end of the thread by the die.

The thread opening die holder can also be employed in threading the job as illustrated in Figure 6. These opening dies have four cutting jaws called chasers which cut the screw threads. These chasers are held in radial slots in the die head and can be instantly withdrawn from the screw thread when the die is opened or released. As mentioned previously, a savings in time can be realized by the use of an opening die as compared to the button die; in this specific case, the job can be completed in 19 seconds rather than 20 seconds.

The various designs of self opening thread chasers would include the tangential, the circular, the hobbed or tapped, and the inserted or milled chasers. In either case, it is necessary to have a chamfer on the individual chasers; this chamfer making it easier for the die to start a thread on the

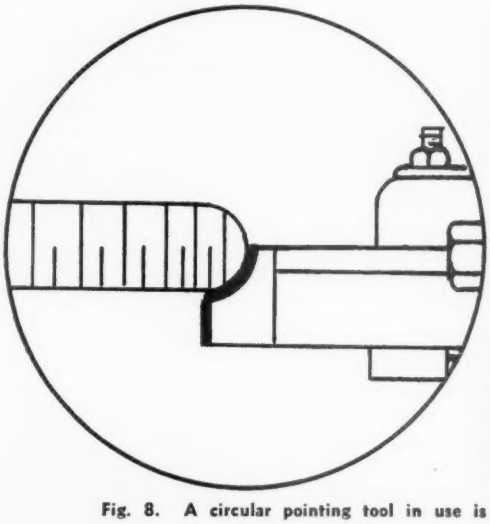


Fig. 8. A circular pointing tool in use is shown as it is applied in this job sequence.

work piece. It distributes the cutting load over several threads, making the chip per chaser thread smaller and the cutting life between sharpenings greater. The chamfer angle and the number of threads to be included within the chamfer will vary; the values given being adapted to both tap and die chasers, thus: — (a) on free cutting steels and most copper base alloys, a 1½ thread, 30° chamfer is recommended; although in the latter type alloys, the throat angle may vary between 20° and 30°[4] for a length of two threads; (b) on both machinery steel, aluminum base alloys and some of the alloy steels, a 2 thread, 20° chamfer is preferred; (c) more difficult work materials such as the tool steels and some of the tougher stainless compositions require a 3 thread, 15° chamfer angle; and, (d) a one thread, 40° chamfer angle is used where only a full depth thread must be cut as close to the shoulder as possible.

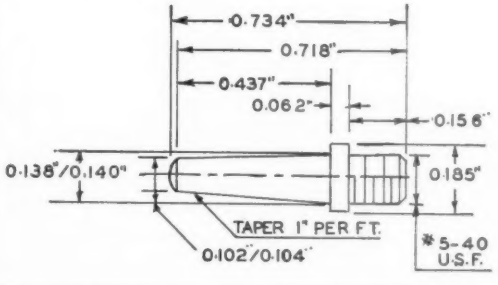
TAPER STUD—

Material—Drill Rod; 0.185" DIA.

Seconds to Make One Piece—24

Gross Production per Hour—150

Equipment—No. OOGHS Brown & Sharpe Automatic Screw Machine



Spindle R.P.M. 355	1450 Rev.	Order of Operations and Tools	Feed per Rev.	Sur. Ft. per Min. of Stock
	17	Index Turret		
	82	Form Front Slide; Support #OOAB Back Rest	0.0005	68
	17	Index Turret Reverse Spindle		
14	14	Thread # OOG Die Holder		9
	17	Index Turret		
	41	Form in #00 LA Swing Tool & #OOBA Adj. Guide	0.001	
	186	Turn in #OOLA Swing Tool & #OOBA Adj. Guide	0.003	
	12	Clear		
	116	Cut Off Back Slide; Index Turret 3 Times	0.001	
	17	Feed to Stop		
	580			

Figure 9

The chamfered surface must not only be ground to the proper angle, but also, it must be ground with the proper concavity to obtain a cutting clearance. The rake or hook angles to be employed will vary with the material. Thus, the rake angle or hook on die chasers for the free-machining, leaded yellow brass and similar compositions may vary from negative 10° to 0°; on those alloys that are readily machinable[4], the rake angle will vary up to 10°; and in the more difficult copper base alloys, the rake angle will vary from 12° to 30°. On both machinery steel and free-machining steels, a recommended rake of 10° has been given[2]; whereas, a 15° rake is employed on tool steels, alloy steels and aluminum base alloys.

When a particular smooth thread is required, or one that is nearer to full depth, two taps or dies are employed as the case may be; one being used for roughing out the thread, while the other is employed for finishing. The character of the work, the type of tap or die employed, and the material cut will determine the procedure to follow; i.e. whether one or two operations are involved. The roughing tap is usually made from 0.010" to 0.015" small and the roughing die from 0.010" to 0.015" large, depending upon the pitch of thread and other conditions of the job.

In the acorn die, the four jaws which do the cutting is very similar to that of a button die, however they are supported by a solid ring of metal at one end of the jaws rather than a slotted ring of metal on the outside of the jaws. This die is adjusted by pulling a conical ring onto the tapered jaws and thus bending them in to cut a smaller pitch diameter. The jaws do all their cutting on the chamfered threads at the front end of the jaws; the chamfer and the chamfer angle being similar to that previously discussed.

Other Frequently Used Tooling Operations

The Skiving Tool — Although the skiving tool is primarily employed for both the aluminum and copper base alloys where a wide formed surface running down to small diameters is required, it can also be employed on materials such as stainless steels where either close tolerances or intricate shapes are to be realized. It is used rather infrequently and because of this, it must be adapted for each specific job. This tool is of blocked design, shaped throughout its length on one surface to the outline to be formed.

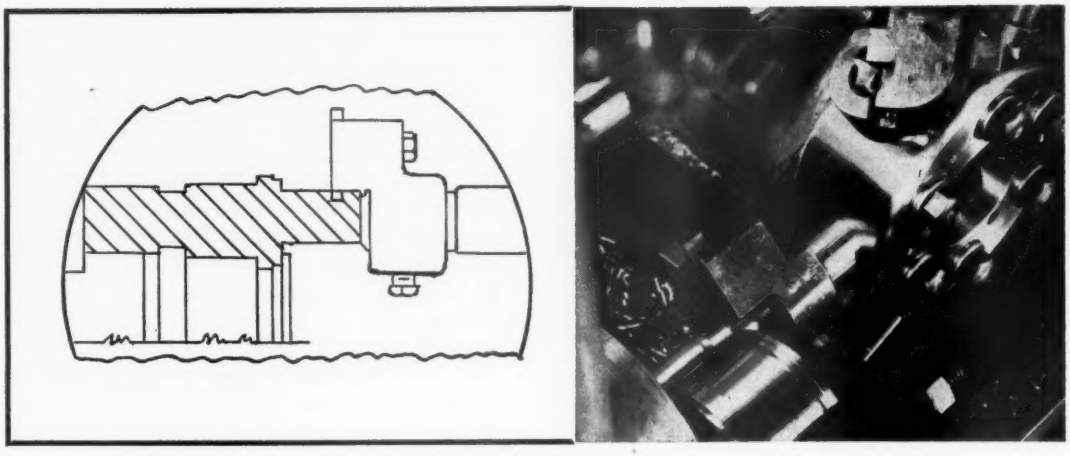


Fig. 10. Back rest supporting work during a forming cut is shown mounted in a turret station.

It is mounted in a suitable holder on either the front or the back slide, usually the latter, and passes under the work. The upper front edge of the block, used for cutting, is applied to the work on a tangent similar to a box tool blade.

The formed surface of the tool should be polished, since the tool continues to pass under the finished work until its full width has been cut. The finished surface of the work rubbing gently on the form tool surface will serve to give the piece a certain amount of polish. In many instances, support for skiving operations are required to compensate for a possible 'springing' action of the stock due to the tool pressure. For some jobs, it may be well to support the stock for its entire length, up to the time the tool starts to cut the diameter to the finished size.

The approach angle used on a skive tool will vary with the material; the softer aluminum base alloys having an angle varying from 30° to 35°. Whereas for the stronger type material such as the stainless steels, the approach angle may be smaller, usually between 5° and 15°. Both clearance and front rake angles are employed; this value also being dependent upon the material to be formed. Thus, in stainless steels, the cutting edge is ground with about a 2° clearance angle, while the front rake angle may be from 10° to 15°.

Swing Tool—This is essentially a swinging arm, one end of which is arranged to hold a blade while the other end is pivoted to a shank to hold the tool in a turret position. This type of tool is quite versatile and can be employed in such operations as both straight and tapered turning, forming, cutting-off and recessing. In straight turning, the swing tool is employed where the standard forming or turning tools previously discussed cannot be used. Thus, this type of tool is preferred where either forming behind a shoulder or where a very slender piece requires a long cut.

In the machining of the tapered stud, as illustrated in Figure 9, the swing tool is a necessity to obtain the indicated taper. As is indicated in the work sheet, other operations, which have been previously discussed, are performed such as circular forming, threading, and cut-off. In this specific application of the form tool, the length of the work piece is several times greater than its diameter which precludes the use of a back rest to support the work while the form tool is cutting; this back rest being mounted in a turret station. This operational sequence is illustrated in Figure 10. Threading is performed with the 'Acorn' type die.

In this specific application, a combination of both cross slide and turret movement is realized. Thus, as the cross slide is fed forward, the swing tool turns a groove in the work piece or faces the inner shoulder of the 1/16" band; this being followed by a turret movement, while the cross slide dwells, which causes the swing tool to turn the desired taper. This operation is illustrated in Figure 11.

As is true with the fundamentals of tool design on previously discussed types of tools, the cutting edge must have a clearance angle to avoid rubbing on the work, and also, must have hook or rake to obtain a free cutting

action. The values used on this job are 12° and 8° respectively. To obtain a smooth finish on the tapered work surface, the front edge of the bit is ground to be either parallel to the work or at the approximate angle of taper. This front edge does the cutting when the bit is first fed into the work by the cross slide cam and has a finishing action as the tool is fed along the taper by the turret movement.

On the opposite side of the bit is the cutting edge (Figure 12) which has the major duty of roughing off the stock as the taper is turned; this edge making a 60° angle with the work axis. The point of the bit formed by the front and side cutting edges is more sturdily supported and has greater resistance to break-down when the angle between the sides can be made greater than a right angle as has been done in this case. If there is a tendency for the chips to obstruct operation and foul the tool, a chip control groove is included.

The swing tool is used as a form tool only when the cross slides have been occupied by tools for other operations; this function being usually applied in a limited way. In addition, as previously mentioned, the swing tool is used for internal work such as recessing, boring and chamfering. As with other tools used for the same purpose, it is essential that their design be as large as possible to obtain maximum strength and stiffness, however the factor of chip room must not be neglected.

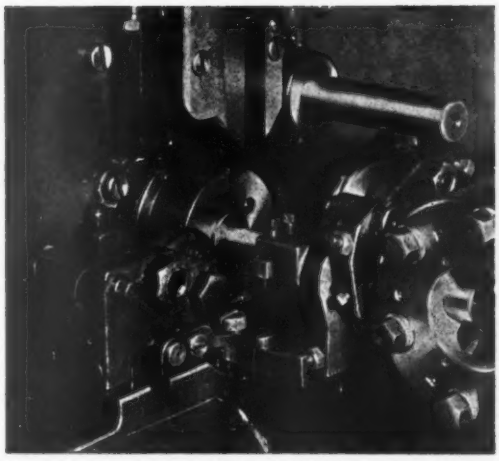


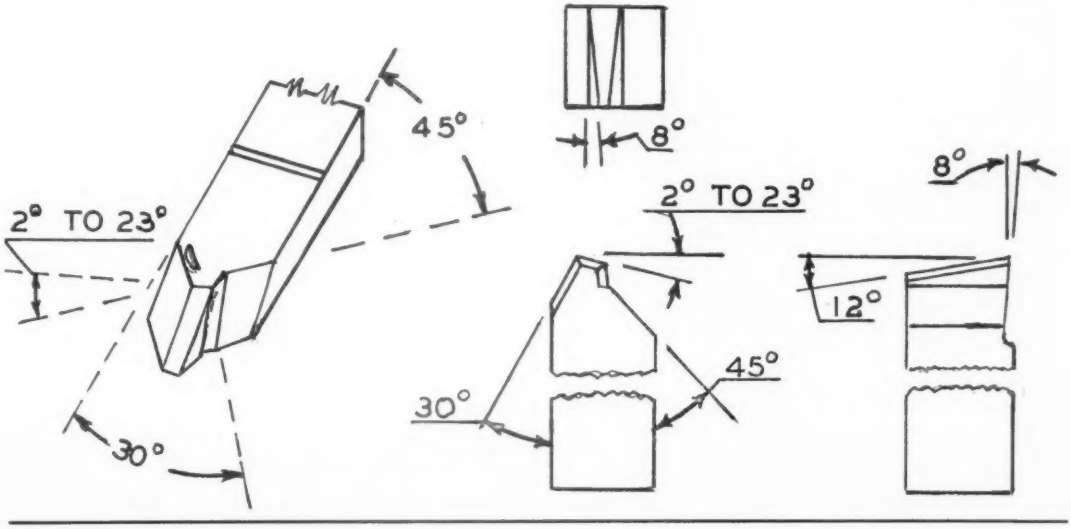
Fig. 11. As the cross slide is fed forward, the swing tool turns a groove or faces an inner shoulder. After a turret movement, the cross slide dwells which causes the swing tool to turn the desired taper.

The Knee Tool — The knee tool is primarily designed for rough turning of short, stiff work, however the blade may be ground to do other operations such as light facing, chamfering, etc. In turning operations, they require considerable less clearance space than balanced turning tools or box tools; this being considered as their chief advantage for this class of work. Usually the adjustment of this cutting tool is rather coarse so that it is not adaptable in producing to close tolerances, and the finished work may show machining lines.

This type of tool has a right angle body; the shank of which is placed in a turret

. . . *Continued on page 62*

Fig. 12. Swing tool bit showing clearance and rake angles [2].



CONTROLLING CUT LENGTH TO 0.0001

HOLDING THE LENGTH OF A CUT to acceptable tolerances on turret lathe operations has been a problem for many years. As early as 1885 a patent was granted for a turret lathe attachment which was intended to better the 0.010" to 0.015" tolerance which had been the best possible obtainable on turret lathes under conventional operations. Since 1885 there have been other patents granted for attachments intended to solve this operational problem.

The writer has designed an attachment with which the length of cut can be held to a tolerance as low as 0.0001", depending on the range of the dial indicator used. A patent is now pending for this attachment.

Reference will be made to letters and figures which are shown in Figures 1, 2, and 3. In many instances the same letter or figure will appear in several of the views.

In Figure 1, the drawing represents a conventional turret lathe to which the control attachment has been applied. The device is installed on the square turret carriage apron or gear box of the cross slide, (A), without requiring any change in the structure or normal operation of the lathe.

The conventional turret lathe has an automatic means of stopping the cross slide feed. It is comprised of a stationary stop rod (E) and a set of adjustable stop screws (F). Each stop screw can be set for a given piece of work so as to stop the cutting operation at a predetermined point. This point corresponds to an unfinished cutting operation. Beyond this point, it is the usual practice for the operator to move the tool-holder still further by means of the hand wheel (G) to complete the cut.

The device is provided with an annular ring plate (1) Figure 3, with a smaller spacing ring (2) as a unit part of the ring plate.

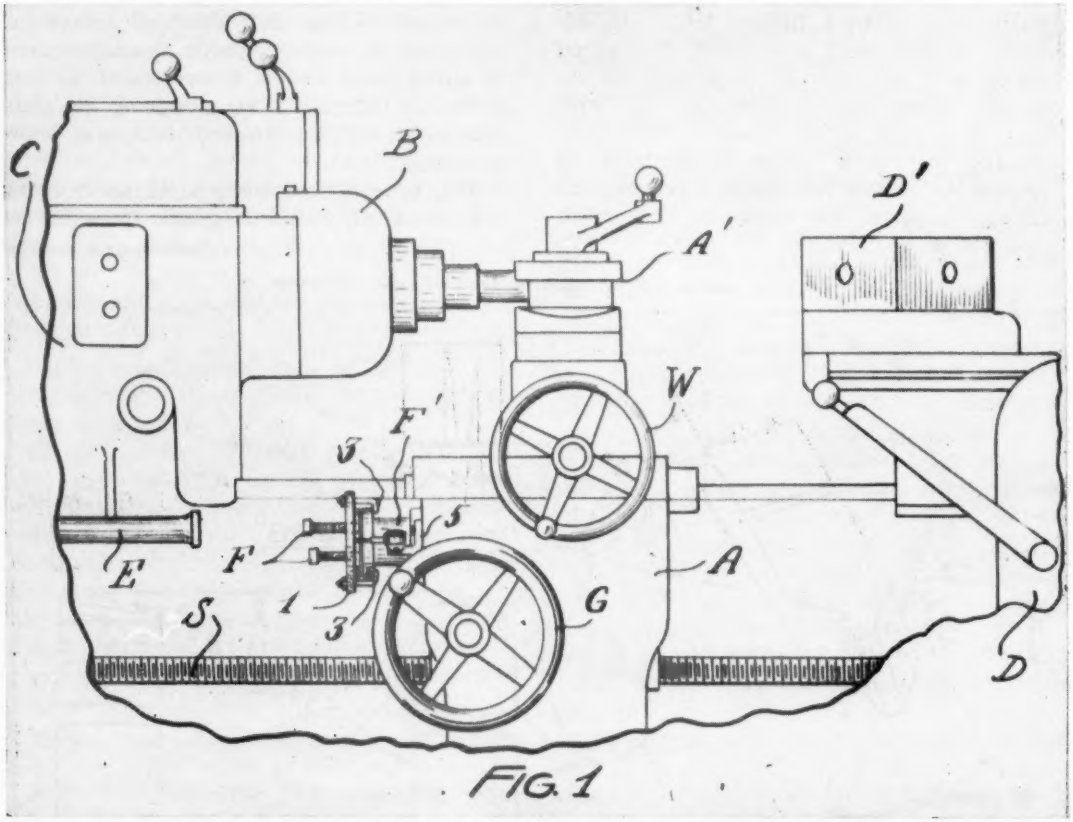


Fig. 1. This drawing is a partial elevation of a conventional turret lathe showing the control device installed on the cross-slide.

TOLERANCE ON TURRET LATHES

by Louis H. Fike
Superintendent
STRAEHLE MACHINE PRODUCTS
Cleveland, Ohio

This ring plate is attached to the stop-screw ring (H) at the forward end of the stop-screw carrier (F) by means of three clamping bolts (3) equidistantly spaced. The ring (2) is for the purpose of allowing proper clearance and may be of different thicknesses in different models of turret lathes. This ring plate is placed over the stop screws (F) so as to preclude any interference with the operation of the lathe. This is one part of the device.

The other part consists of a dial indicator (4), Figure 2, of a standard type that is mounted upon a right angle bracket, (5), and the bracket is attached to the cross-slide carriage apron (A). The two legs of the bracket are slotted to provide vertical and horizontal adjustment of the dial indicator position as shown at (5).

In assembling the device, the indicator will be set so that its spindle (10) will contact the plate (1) and the needle will be set at a predetermined point upon the dial.

Now, while still following the same procedure as in the operation of the conventional turret lathe to the point of feed shut-off, the succeeding manual operation of the handwheel (G) will bring the cutting tool up to the stop screw carrier; that is, the tool holder will be moved forward until the automatic stop screw (F) meets the stationary stop (E). At this juncture, the indicator spindle (10) contacts the ring plate (1). As the operator continues to feed the cutting tool into the work, the indicator spindle actuates the indicator needle. Thus the extent of such supplemental movement of the cutting tool by the operator may be indicated

. . . *Continued on page 121*

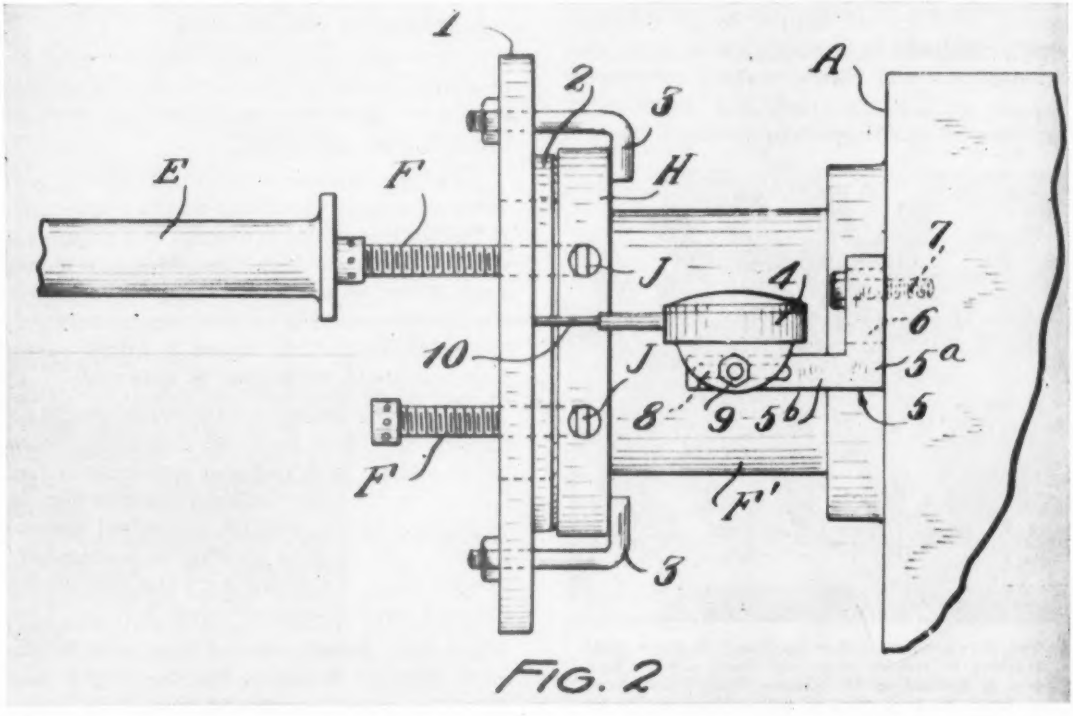
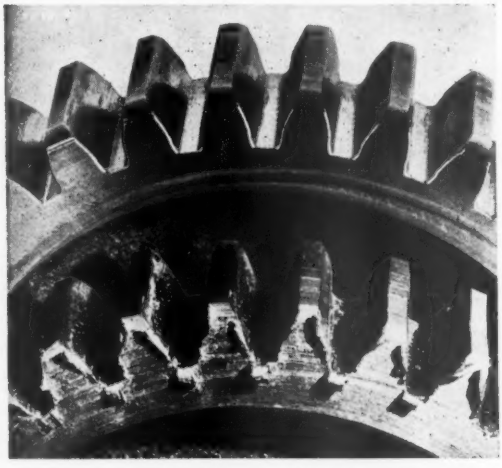


Fig. 2. This is an enlarged view of a part of Fig. 1 with the automatic stop in engagement.

POWER BRUSHING
. . . Factors in the Selection of Brushes

THOUGH POWER BRUSHING has been used in industry for years, its widespread application as a production process has come about chiefly in the last two decades. To relieve production bottlenecks, especially in the manufacture of precision parts, many new applications and brush constructions have been worked out in the last few years. Brushes are tools, and as such are used on many jobs including the conditioning of surfaces to achieve specific characteristics; removing of burrs, slivers, and lightly attached particles; finishing of edges by blending the juncture of adjoining surfaces in a smooth full-rounded edge; removing surface films and encrustations; or, causing the movement of materials from or along a surface.

There is a best technique for each individual brush application. Specific rules for dealing with the many variables associated with power brushing would be numerous and plagued with exceptions. Each job has its own characteristics, and each should be studied by someone thoroughly familiar with power brushing techniques, brush construction, and effects of brushing speed, brush size, filament size and nature, manner of presenting the work to the brush, and the selection and use of auxiliary compounds, if needed.



Gear shown, below, before brushing and, above, after brushing to remove burrs and sharp edges. Each gear is finished in 18 seconds, floor-to-floor time, as compared to 3 minutes with a hand tool. No secondary burrs or sharp edges are created by brushing.

by R. O. Peterson
Manager, Technical Department
THE OSBORN MANUFACTURING COMPANY
Cleveland, Ohio

Brush selection is best done in the light of experience and experimentation. In selecting a brush for trial, the most important job requirements to be considered are:

1. General nature of work to be done—removing of burrs or scale, refining of surfaces, blending arjoining surface junctures or irregularities, etc.

2. Surface finish requirements.

3. The type of material from which the work part is made; its condition at the time of brushing; and its physical properties, especially hardness.

4. Limitations related to clearance, size, and restricted areas.

5. Specifications requiring definite results, such as rounding an edge to remove 0.015″ of material measured from the vertex.

6. Production rate required.

7. Type of equipment available or to be procured—brushing lathe, standard or special automatic brushing machine, portable or flexible shaft equipment.

An abbreviated brush selection chart is provided as a guide in making this first selection. If the work material is a metal and requires a surface finish or less than 30 micro-inches r.m.s., a certain group of brushes is indicated. On the other hand, if surface roughness is permitted or required to exceed 30 micro-inches, a second group of brushes is indicated.

Three major brush characteristics should be considered. These are brush flexibility, brush finish ability, and speed of brushing action. Arrows on the chart indicate the direction in which to look for a brush of desired characteristics. Thus, it is possible to successfully select a brush for preliminary trial within the range of applications indicated.

The first brush selected may not be the most efficient brush or the one which produces the desired results. A single trial usually demonstrates the need of any corrective

For Jobs Requiring Surface Finish Less Than 30 Micro-inches, rms			For Jobs Which Permit or Require Surface Finish Exceeding 30 Micro-inches, rms*		
Brush Flexibility: Medium → High			Brush Flexibility: Low → High		
Brush Finishing Ability: Very Fine (Low rms) → Medium			Brush Finishing Ability: Fine → Course		
Brushing Action: Medium → Very Fast			Brushing Action: Medium Fast → Medium → Fast		
Cord & Fabric Brushes	**Tampico & Treated Tampico Brushes**	**Fine Wire Sections Used With Burring Compound**	**Wire Wheels**	**Wire Sections**	**Coiled Knot Sections**
Major Brush Characteristics					
Fast cutting, medium flexible wheels. Used with cut and color buffing compounds for producing low micro-inch finishes	Flexible, fast cutting wheels. Used with burring compounds of tacky composition for producing surface finishes of approx. 8 to 10 micro-inches rms	For efficient use of wire brushes with compound, select brushes having medium or high density and fine wire size (0.008 diam or finer)	Wide face, dense fill. Used where fast cutting and fine finishes are required. Best general purpose wire brush	Narrow face, medium density. Used where medium brush flexibility is essential to follow contoured surfaces	Narrow face, low density. Used where a high degree of brush flexibility is needed and where surface impact action is necessary, especially to remove surface encrustations
Major Applications in Order of General Usage					
1. Cut and color buffing 2. Surface blending 3. Light scale removal 4. Producing radii 5. Burr removal	1. Burr (small) removal 2. Producing radii 3. Light scale removal 4. Surface blending 5. Cleaning 6. Satin finishing	1. Burr (medium) removal 2. Light scale removal 3. Satin finishing 4. Producing radii	1. Burr (heavy) removal 2. Producing radii 3. Rust and oxide removal 4. Scale removal 5. Cleaning 6. Surface blending	1. Cleaning 2. Medium scale removal 3. Rust and oxide removal 4. Satin finishing 5. Surface blending 6. Burr removal	1. Heavy scale removal 2. Rust and oxide removal 3. Satin finishing 4. Producing radii 5. Burr removal (on very hard metals)
Adjustments For Desired Results					
Brush works too slowly	**Brush works too fast**	**Action of brush peens burr to adjacent surface**	**Finer or smoother finish required**	**Finish too smooth and lustrous**	**Brushing action not sufficiently uniform**
1. Increase surface speed by increasing OD or rpm 2. Decrease trim length and increase fill density 3. Increase filament diam	1. Reduce surface speed by reducing rpm or OD 2. Reduce filament diam 3. Reduce fill density 4. Increase trim length	1. Decrease trim length and increase fill density 2. If wire brush tests indicate metal too ductile (burr is peened rather than removed), change to nonmetallic brush such as a treated Tampico used with burring compound	1. Decrease trim length and increase fill density 2. Decrease wire diam 3. Try treated Tampico or cord brushes with suitable compounds at recommended speeds 4. Use auxiliary buffing compound with brush	1. Increase trim length 2. Reduce brush fill density 3. Reduce surface speed 4. Increase filament diam	1. Increase trim length and decrease fill density 2. Devise hand held or mechanical fixture or machine which will avoid irregular off-hand manipulation

*For very ductile metals, see Adjustments Column 3

Chart for selection and specification of brush requirements.

action for achieving a suitable brush specification. The lower part of the chart lists the six conditions commonly encountered, together with the corrective measures to be taken.

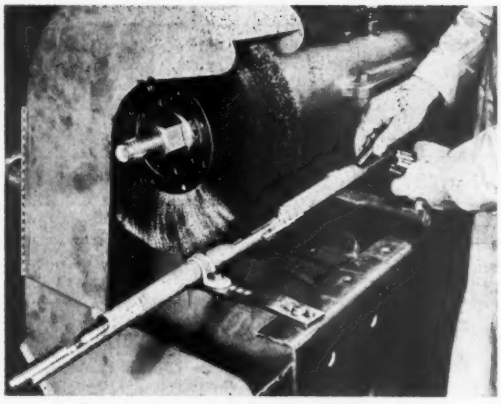
In the final selection of a brush, the following specifications are important: Type of fill material (wire, fibre, nylon, etc.), size of filaments, trim length, density of fill, quality of fill material, outside diameter of brush, face width and surface speed.

For practical selection, brushes may be classified as follows:

Cord or Fabric Brushes. Fast cutting, medium-flexible brush wheels used with cut and color compounds for producing fine finishes, below 10 micro-inches.

Tampico and Treated Tampico. Flexible, fast cutting wheels used with burring compounds of tacky composition for producing surface finishes of approximately 8 to 10 micro-inches.

Fine Wire Brushes. For efficient use of wire brushes with burring compounds, select those having medium or high density and fine wire size (0.008" diameter wire or finer). These



Power brushing removes sharp edges and improves surface finish, without changing thread shape or size. Operation relieves stress-concentration problem. The "stovepipe" method of presenting work to the brush merely requires that studs be inserted at one end, with brushed work automatically ejected at the other end.

brushes provide finishes below 30 microinches.

Wire Brush Wheels. Wide face, dense fill; used where fast cutting and fine finishes are required. Good general-purpose brush.

Wire Brush Sections. Narrow face, medium density; used where medium brush flexibility is essential to follow contoured surfaces.

Coiled Tuft Brush Sections. Narrow face, low density; used where high brush flexibility is needed and where surface impact action is necessary, especially to remove surface encrustation.

Industrial brushes are also classified in three general categories, according to their construction—helical, straight strip, and sectional.

Cylindrical brushes having their filaments mounted on helical strips are particularly well suited for those applications where wide brush faces are required, where a continuous uniform density of fill is required, and where brush life is critical.

Cylindrical brushes of straight strip construction may also have wide faces, but generally have a low fill density. These brushes are most commonly used on "service" applications such as cleaning conveyor belts and mechanical floor sweeping, where the open face avoids loading up of the roll.

Brush sections of narrow face width can be used to build up a much wider brush face. Generally speaking, this type of brush is used within the range of ½" to 6" brush face width. Beyond this width, cylindrical brushes are used. Sectional brushes provide greater economy through lower inventories, adaptability to a greater number of jobs and replaceability of only those sections exposed to fast wear, an important consideration on contour brushing.

The hub of a well made brush section is accurately formed to permit sections to be used side-by-side. Sections are readily adapted to fit any suitable standard arbor. Adaptors and flanges are supplied for this purpose.

Cooling by ventilation is often required, particularly with non-metallic brush material, with large face widths and continuous work cycles. Ventilation is provided by means of air vents in the hubs, facilitating flow of air which practically eliminates scorching or burning. Cores, adapters, and flanges are available that ensure a flow of the cooling air inwardly through the central hub of a brush and out between the filaments.

In the operation of non-metallic fill brushes, a temperature of 130°F should not be exceeded. Brushes operating at 130° F or higher will show a relatively shortened life, or may burn.

Flexibility of the brush fill provides one of the most important advantages inherent in

Power brushing deburrs airplane gears 50 times faster. Gear teeth were formerly rounded by hand, requiring 2½ hrs. each. Even with skilled hands, scrap loss was high. Power brushing cut the finishing time to 3 minutes per gear. Operator simply loads and unloads the machine. With present standards, none of the hand finished gears would have passed inspection.

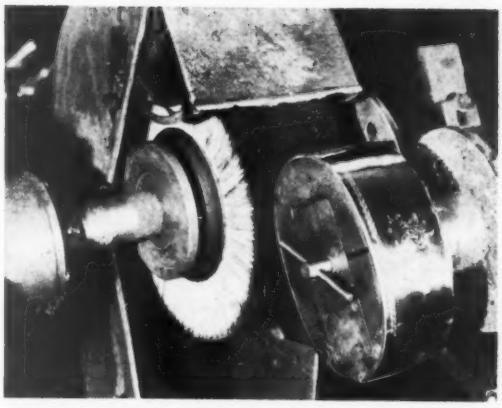
power brushing. This flexibility enables the brush to conform to the many irregularities and contours of a part. In contrast to this, the more abrasive wheels or belts tend to work on the high spots only. A brush, by penetrating surface irregularities and shallow recesses, is able to blend such details with the general surface. Blending, in addition to promoting a pleasing appearance, disperses those stresses which would otherwise concentrate at sharp edges to facilitate fracture and set up differences in electrical potential to promote corrosion.

The subject of repeated or reversed stress is becoming more and more important because of the higher speeds developed by today's aircraft, automobiles, machine tools, and other machinery.

Fatigue failure due to "progressive fracture" starts at some point in the material where the actual stress is much larger than it should normally be. A high localization of stress may be caused by a sharp irregularity in shape such as a sharp edge, a scratch, or tool mark, and produces a minute fracture which then enlarges until, as the stress is repeated often and severely enough, the whole member ruptures.

It has been estimated that the primary cause of up to 80% of machine part failures is stress concentration and progressive fracture. Fatigue failure commonly occurs in the presence of an abrupt change in cross-section, such as a square shoulder, V notch, screw thread, or keyway. After the designer has done all he can, it is up to manufacturing not to introduce any avoidable faults. Power brushing can be helpful in preventing the adverse effects of sharp edges, burrs, tool marks, scratches, and the like. The brush blending of surfaces and details aids materially in avoiding excessive stress concentrations.

A power brushing specialist helps design a high production setup for brush-finishing of clutch discs.



Brushing blends surface imperfections and embossed or engraved designs. Curved surfaces such as these steel toaster shells can be given a high uniform polish with ease, due to the flexible nature of the brush. Fine design details are well blended but remain unblurred and clear in appearance.

In the case of bolts and studs that tend to rupture after being subjected to many repetitions of a tensile load, failures may start at a sharp corner in the root of the thread or at some point of highly localized stress due to pressure of a burr or a scratch produced by a burr. Removal of burrs and sharp edges and improvement of the surface finish, without removing any appreciable amount of useful metal, helps spread internal stresses and assists in overcoming the basic problem.

Some investigators have presented data to show that a sharp edge and a row of burrs may reduce the endurance limits of a part by as much as 50%. Power driven brushes, while removing burrs, can produce simultaneously the smooth surfaces and well rounded edges that are essential to long service life of the part.

In deburring parts by brushing, it is possible to remove enough metal along junctures of surfaces to produce uniformly rounded edges, while adjoining surfaces are refined without any measurable removal of useful metal. In contrast, a fixed-grit wheel, cutter, or file tends to remove enough metal from a surface greatly to change part dimensions.

Cord brushes have shown outstanding results in this type of work. They can produce

. . . *Continued on page 124*

AUTOMATIC ARC WELDER JOINS DUAL EXHAUST PIPES TO FLANGE

Unusual set-up lays down a circular bead under granular flux that submerges the arc. Weld across diameter is made by hand.

by Herbert Chase

MANY PRODUCTION PROBLEMS were encountered in building the new Buick V-8 engine and in adapting it for connection to chassis components. Not the least of these involved welding two pipes (that lead exhaust gases from the two exhaust manifolds) inside the hole in a common flange subsequently bolted to a mating flange on a pipe leading to a muffler. After the two pipes whose ends are formed to a "D-shape" section are welded to the flange the straight sides of the "D" have to be joined by an arc weld running across the diameter of the holes as seen in Figure 1.

Production of the circular automatic submerged arc weld was the chief problem in this assembly which is made complete in the Buick plant. This weld is made in a new National welder said to be the first of this make designed for automatic arc welding. Figure 2 shows this machine as well as the two pipes in a clamping fixture that is an important unit in the production set-up.

Before the weld is made the "D-shaped" ends of the two pipes have to be entered in the flange hole and all three parts clamped so that the ends of the pipes are about 3/16 inch away from the flange's top face. In effect, this leaves a step in the hole and the weld head has to be laid down in the corner between the step and the bore of the flange. This requires that the welding electrode wire be directed toward the corner and at an angle of about 45° with the hole axis.

In making such an automatic circular weld, it is necessary either to move the welding head around the circle with the work fixed or to fix the head and rotate the work as the welding proceeds. The latter alternative was selected and it was decided to keep the electrode wire vertical. This made it necessary to incline the clamped flange and mating parts so that the flange face is at a 45° angle in relation to the electrode.

Placing the parts at this angle helps to keep the granular flux piled around the electrode so that the arc will remain submerged as required. As one of the pipes is quite long and has a 90° sweep bend, this pipe therefore describes a sizeable circle when the whole clamped set-up is rotated, as it has to be, about the axis of the flange hole.

In loading the bronze fixture, the flange bolt holes are placed over locating pins and hinged cover plates are closed and locked against the flange face. These plates help to keep the 3/32 inch weld bead below the face as is required. Toggle clamps lock both pipes into the fixture and there is another toggle clamp at the lower end of the long pipe. Above the fixture is an offset flux pipe through whose lower swiveled end the ⅛" wire electrode passes vertically from the Lincolnweld automatic head above.

Photos Courtesy Lincoln Electric Company.

Fig. 1 Close-up of a weldment that includes two pipes whose ends, formed to D-shape contour, are inserted in the hole of a mating flange. An automatic machine makes the circular arc weld but the straight weld across the diameter is made by hand.

Rotation of the fixture is effected by a gear that is turned by a rack connected to the plunger in an inclined air cylinder provided for this purpose and seen on the left side of the machine in Figure 2. As it requires about 11 seconds to make the weld, air control valves are so set that the fixture makes one revolution in this time.

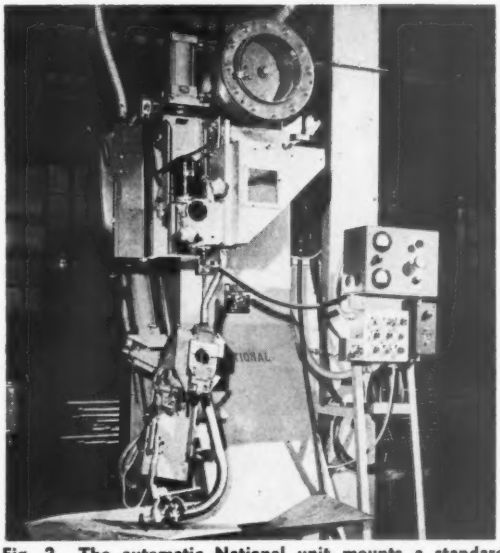


Fig. 2 The automatic National unit mounts a standard Lincoln welding head that produces circular welds to join two exhaust pipes to a flange in the fixture shown. While welding proceeds, an air operated rack engaging a gear causes the fixture and weldment to rotate slowly.

Welding wire is fed automatically by the head from a coil on a reel on top of the machine and No. 760 Lincoln flux is fed from a hopper below the reel. Current of 350 amp at 24 volts is supplied by a DC generator mounted overhead but attached to the welding machine only by wiring.

After the fixture is loaded by hand the machine operator presses a start button and the machine runs through its cycle automatically. As the electrode wire feeds down to contact the work and strike the arc, flux feed starts and continues, to keep the arc covered, until the weld is completed. At the moment the arc is struck, rotation of the fixture starts and continues for one full revolution until the bead is completed. Welding time is about 11 seconds.

At the moment of completion current is shut off, the electrode retracts, rotation and flux feed stop and the fixture is ready for unloading by hand. While welding as well as when the fixture is unloaded, excess and unfused flux falls from the fixture or is dumped from the pins into a hopper below the fixture and falls down a chute to a vibrator screen. There any fused particles are separated out.

Remaining granular flux is elevated by a small conveyor to a holder well above the machine and is fed back to the machine hopper as needed. As a result only flux that is fused is discarded. Some fused flux sticks to the weld but is easily loosened. Most of it, in fact, drops off when weldments are handled.

Although the weld needed to join the straight edges of the pipes already welded inside the flange could be made automatically, it is so short and so simple to make by hand that this course is followed. As this procedure is conventional, processing details are not included here.

It is worth noting, however, that the automatic production of the circular weld is not only faster but results in uniformity not attained in hand welding. Moreover, as the arc is submerged the machine operator does not have to wear a mask and need not be a skilled welder because the machine produces the weld. Actually the operator merely loads and unloads the fixture and presses a button to start the welding cycle.

BODY ENGINEERS

Automotive body engineering as a highly specialized branch of the profession will again be recognized by more than 3,000 Men of Industry when they meet in Detroit for the Seventh Annual Technical Convention of the American Society of Body Engineers. The Convention will be held October 28, 29, and 30 at the Rackham Memorial Building in Detroit.

More than 30 manufacturers supplying the body builders will exhibit their latest developments. Among the exhibitors will be The American Bosch Corp,, Burlington Mills, Inc., Douglas & Lomason Co., Eaton Manufacturing Co.. Libbey-Owens Ford Co., Prestite Engineering Co., Randall Co., Soss Manufacturing, Trico Products Corp., B. F. Goodrich Co., etc.

In addition, speakers will deliver technical papers on such subjects as Body Interiors, Purchasing of Body Parts, Die Engineering, Body Materials, Body Safety, Sports Cars, and Air Conditioning. The entire program is designed to meet the needs of stylists, designers, manufacturing engineers, and others who are interested in automotive body engineering.

Further information on the technical program, exhibits, or registrations should be requested from the American Society of Body Engineers, Inc., 100 Farnsworth St., Detroit 2, Michigan.

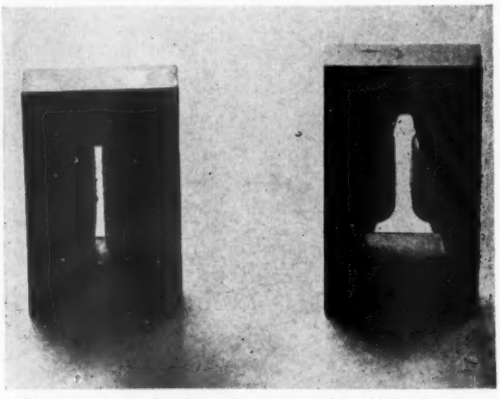
ULTRASONIC MACHINING
. . . of Carbide and Other Hard Materials

RAPIDLY EMERGING from the laboratory is a process for doing what diamonds do and what diamonds will not do, by means of mechanical vibrations acting through a cutting medium consisting of finely divided abrasive particles suspended in a liquid carrier.

The liquid commonly used is water. The abrasive is—not diamond as might be supposed, but—relatively low cost boron carbide, silicon carbide, or aluminum oxide. Power consumption is amazingly low. "Soft" tool materials are normally used. Tool changes are accomplished swiftly.

Casual mention has been made in previous issues to this process . . . the Cavitron ultrasonic process for machining cemented carbide, hard tool steels, tungsten, alnico, diamond, sapphire, boron carbide, and many other hard metals and non-metals. It is not applicable to plastics, lead, and other soft materials. This process constitutes an entirely new approach to cutting, drilling, threading, grinding, polishing, and other operations in which stock is removed from the workpiece.

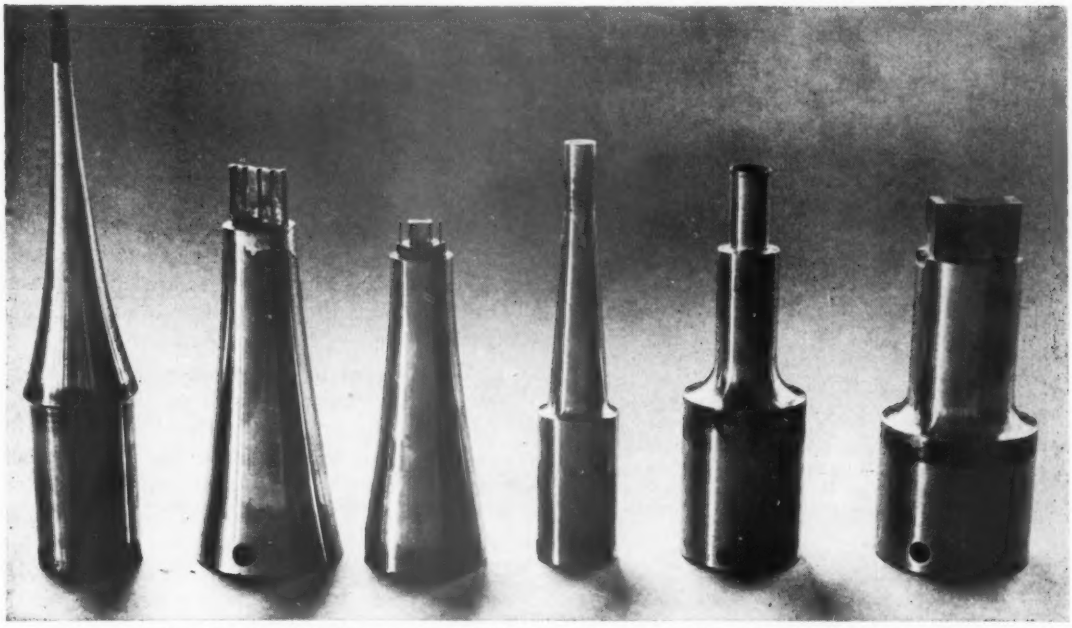
Ultrasonic transducer assembly, with tool holder attached below, and tool brazed onto end of the tool holder. Transducer generates longitudinal vibrations, transmitted to the tool through the holder.



Clean cuts made through cemented carbide dies by ultrasonic energy . . . using no diamonds.

The Cavitron process is unique in that the tool does not rotate; rather, the tool movement is of a reciprocating nature, in the direction of penetration of the tool into the work. The axial motion of the tool permits "drilling" of holes of odd or complicated contours. It also permits direct reproduction of shallow designs of fine intricate detail, such as is normally produced by engraving tools. The latter field of application has led to the name "Ultrasonic Engraving Process"; although it is far from being limited to use in this field.

Why call it "ultrasonic"? The study and use of ultrasonic waves—or vibratory energy—constitutes a relatively new science. These are high frequency alternating compressional waves, the behavior of which is similar to that of sound waves. Since the frequency of these waves (Cavitron normally 27 kc) is above the audible range (20 kc), the name of "ultrasonic" has been employed. Frequently misused, the term "supersonic" means only "faster than the accepted speed of sound" and is never properly applied in the discussion of ultrasonic energy.



Various types of tools and tool holders. The tool holder transmits and amplifies vibrations. Note that the tool second from the right is tubular; it will cut a round hole while producing a usable core of the work material.

The working tool, which is perishable, is made of a soft, easily machined material—usually unhardened steel. The tool face corresponds to the recess or cavity to be formed in the workpiece, but with all details inverted. The tool is brazed or otherwise mounted on the lower end of a truncated metallic cone, or tool holder, which in turn threads into the transducer assembly.

The transducer is electromechanical—that is, it receives high frequency alternating current from an appropriate power source and converts this electrical energy to mechanical force in the form of axial vibrations. The transducer comprises a driving coil and a water-cooled, laminated, magnetostrictive element. Length of the element changes in proportion to the square of the magnetic field provided by the driving coil. Linear dimensions of the element determine the frequency range of operation.

The truncated cone, that is the tool holder, transmits and amplifies these vibrations, approximately 27,000 per second. A liquid suspension of finely divided abrasive particles is fed to the tool end in a continuous stream. The vibrating tool moves over a distance of approximately 0.001" (for most appplications) with each stroke, and acts as a very rapidly reciprocating driver against the myriad of constantly changing abrasive particles interposed between the tool and the work. This vibrating motion of the tool is not visible.

Under light but continual pressure, the tool feeds itself into the workpiece. This rate of feed varies somewhat, according to the particular work material and operation involved. Cutting rates currently used are sufficiently high for competitive operations. The Cavitron tool develops accelerations in excess of 40,000 times gravity, and extraordinarily large forces are exerted in the work area. The result is that the abrasive particles spawl out minute particles of the work and an opening or recess is formed duplicating, in reverse, the shape or configuration at the end of the tool.

Soft steel tools, subject to wear, are quickly replaced on the tool holder by conventional brazing techniques.

Ultrasonic machine in operation, utilizing special setup. Boron carbide in a liquid carrier is washed across tool and work through tubes shown.

It is important to note that, while the tool and work are at all times urged together, the inertia of the work is such that it does not follow the rapid vibrations of the tool. This permits abrasive particles to be continuously distributed throughout the cutting area. Also, since the tool is constantly in motion, abrasive action on the tool is appreciably less than that on the work and permits general use of low-cost tool materials.

Among the many materials on which the ultrasonic machining process has been successfully applied are cemented tungsten carbide, titanium carbide, quartz, glass, sintered aluminum oxide, hardened steel, manganese steel, Ni-hard, aluminum, magnesium, ruby, sapphire, germanium, ferrites, granite, ceramics of various types, and other materials.

The process has been used to make dies of all kinds in hardened steel and carbide including those for embossing, extruding, cold heading, marking, wire drawing, and the like. The Cavitron process is also adapted to sharpening carbide tools, making form tools, and grinding chip breakers (See T&P, Feb. '53, "An Evaluation of Diamond-Substitute Processes").

An important feature of the process is that it involves extremely low stress and no local heating. Accordingly, there is no thermal cracking, pitting, or burnt coloring. There is no physical or chemical change in the material being worked. Excellent surface finishes are obtained.

Where the work can be moved laterally relative to the Cavitron tool, large areas can be machined, cut, or ground. At the present time, with a stationary workpiece, Cavitron equipment cuts openings over an area of approximately 2" diameter. A new unit, now under test, is designed to cut over an area approximately 4" in diameter.

Roughing operations are carried out with 280-grit abrasive, providing accuracies of 0.002" or better and finishes in the order of 25 micro-inches. Using finer grit sizes, greater accuracies and finer finishes are obtained—up to and including a polished surface, and with tolerances held to tenths.

With proper tooling, closely grouped single or multiple through-holes or blind recesses (square, round or any shape) can be positioned accurately relative to one another, and can often be formed in a single operation.

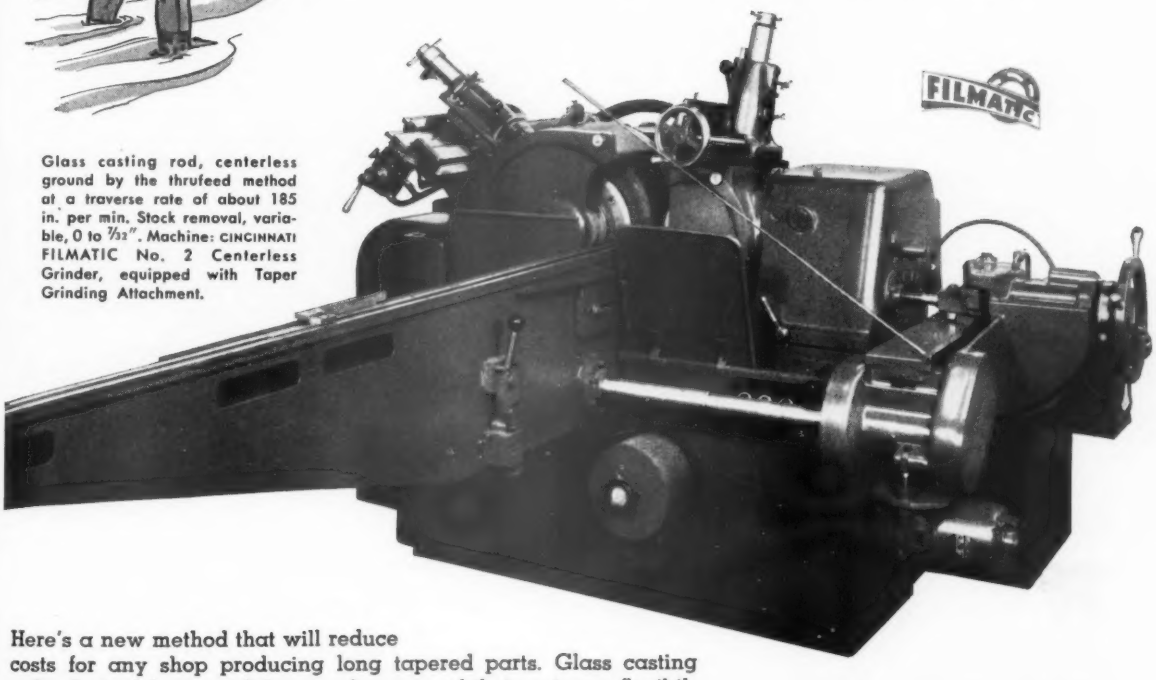
Some of the more unusual applications are, of course, the most difficult to perform. For example, using the screw itself as the tool, an accurate tapped hole can be produced in carbide. Although this requires special fixturing to rotate the workpiece properly, the problem is no more complex than others faced by toolmakers in their daily work. The real problems of producing and transmitting ultrasonic energy and of tool design, have been solved.

The next stage of development will likely be to package the present equipment more effectively as a fully integral unit, either to do a specific job like production grinding of chip breakers or to perform a wide variety of work with minimum special tooling. Meanwhile, the equipment now available will handle many common—but normally difficult, time-consuming, and costly—operations, and will do them easily and quickly.

Intricate designs to right and left of medallions are in cemented carbide. Center medallion is tool steel, the one below is agate quartz, and the top one is synthetic ruby.

Cincinnati Filmatic Centerless

Automatically grinds taper on glass casting rods



Glass casting rod, centerless ground by the thrufeed method at a traverse rate of about 185 in. per min. Stock removal, variable, 0 to 7/32". Machine: CINCINNATI FILMATIC No. 2 Centerless Grinder, equipped with Taper Grinding Attachment.

Here's a new method that will reduce costs for any shop producing long tapered parts. Glass casting rods, desired by most fishermen because of their extreme flexibility and high strength, are now *centerless ground* by the thrufeed method. To perform this operation, a CINCINNATI FILMATIC No. 2 Centerless Grinder is equipped with a taper grinding attachment. The work is mechanically pushed between the wheels at a rate of about 185 in. per min. As feeding progresses, the regulating wheel unit, through a cam and hydraulic cylinder arrangement, increases the distance between the wheels. Exceptionally accurate tapers are produced within ± .001" in 3" increments of length. By changing the cams and/or the change gear ratio, almost any desired taper can be thrufeed centerless ground. ¶ This ingenious centerless taper attachment, coupled with the advantages offered by CINCINNATI FILMATIC Centerless Grinders, give you a combination that can't be beat for low-cost accurate performance. One feature alone, FILMATIC grinding wheel spindle bearings, is sufficient reason to choose Cincinnati. And as always, our Application Engineers will be glad to help you with your precision grinding problems.

Deliveries on standard CINCINNATI FILMATIC No. 2 Centerless Grinders (above) are better than you might imagine. They are versatile precision grinding machines for small quantities or large lots. You may obtain complete data by writing for catalog No. G-611-1.

CINCINNATI GRINDERS INCORPORATED • CINCINNATI 9, OHIO

CINCINNATI CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES
CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

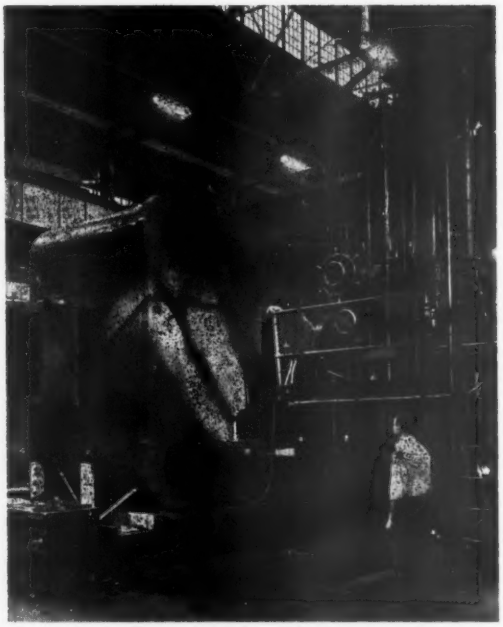
SEE ADVERTISERS INDEX, BACK OF BOOK, FOR INFORM-A-GRAM KEY NUMBERS

11,000-Ton Split-Die Forging Press

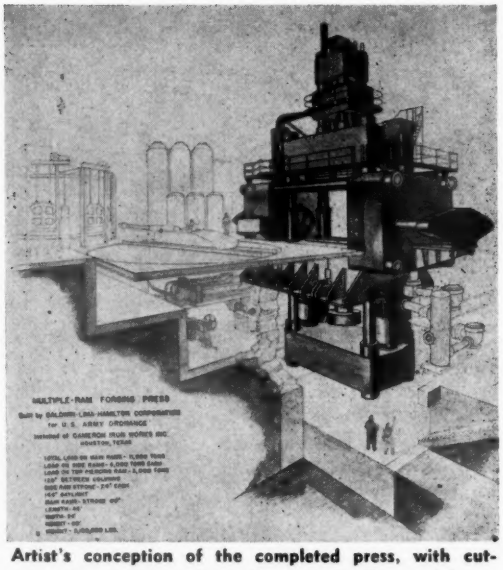
The largest split-die forging press in the world is under construction in the Southwark shops of Baldwin-Lima-Hamilton Corp. for the U. S. Army Ordnance. Upon completion, the press will be installed in the Houston, Texas plant of Cameron Iron Works, Inc. The 60′ tall multiple-ram press will stand in a 40′ pit.

The new press, with a capacity of 11,000 tons, will be equipped with a piercing ram at the top and a knockout ram at the bottom. Two horizontal side rams will be used for clamping vertically split dies, or for piercing when using horizontally split dies. With a bolster area of 10′ x 10′, the press will have a maximum vertical opening of 12′ and maximum horizontal clearance between side-ram faces of 15½′.

Split-die forging capacity at Cameron Iron Works will be greatly increased by the addition of this new larger press. Cameron pioneered in this field many years ago, when they installed the first press built for split-die work. By this process, intricate shapes and forms—otherwise produced only by casting—can be successfully forged. Closed split dies permit practically no draft on forgings, and there is little or no flashing to be removed from the rough part.



Massive top platen being machined on a horizontal boring mill. The platen, weighing about 297,000 lbs., is of welded steel plate construction, with cast-steel column husks welded integrally into the platen.



Artist's conception of the completed press, with cut-away view to show foundation construction and lower details of press design.

Main pull-down capacity of the hydraulically-operated press will be supplied by two 51″ dia., 60″ stroke, single-acting cylinders of 5500 tons each. Two 18½″ cylinders, with a net stripping capacity of 300 tons, will be used as pullbacks. The two 48″ side-ram cylinders have a stroke of 24″ and a capacity of 6000 tons. Two pullback cylinders on each side have a combined capacity of 500 tons. Top piercing capacity of 3000 tons is furnished by a single 38″ cylinder, having a 24″ stroke. Two pullback cylinders will supply 300 tons net stripping capacity. A double-acting bottom piercing cylinder will have 750-ton piercing and 280-ton pullback capacity.

All of the platens, base, check sections, and similar components for this mammoth machine were fabricated from steel plate, some of which are 6½″ thick. Before welding, it was necessary to preheat the plates with gas torches. After assembly of each part, complete with bracing plates, column husks, etc., it was placed in an immense heat treating furnace for stress relieving.

Jewelers Lathe And Guided Missiles

It is not generally known that the production of guided missiles involves the making of small parts to extremely small tolerances. At Bell Aircraft Corporation, one of only four companies holding prime contracts for both missile airframe and power plant, tolerances of from .0001 to .0002 inches are specified by design engineers.

Photo courtesy Louis Levin & Son, Inc.

Jeweler's lathes are among the most essential pieces of equipment in the missile laboratory. Their sensitivity and the fine finishes possible makes them most useful for this class of work. The illustration shows a machining operation on a servomechanism valve for a guided missile. Extreme accuracy is important if the "bird" is to perform its mission satisfactorily.

New Backing on Diamond Wheels

Diamond Tool Research Co., Inc. announces a new backing for straight periphery diamond wheels. Although the formula is a trade secret, it is known that a high aluminum powder content in the plastic back gives excellent heat conductivity. This makes for fast, cool cutting and long wheel life. Even the large 10" diameter wheels run absolutely true without the uneven distortion frequently induced in this type wheel by harmonic vibrations. All current deliveries of straight wheels are being made with the new backing.

2+1=4

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PRK-33 Air Hardening, Non-Deforming Cobalt, High-Carbon, High Chrome. For high production blanking, forming, drawing, trimming and shearing.

NEOR The Original Oil Hardening, Non-Deforming High Carbon, High Chrome. Recognized as the ideal lamination die steel. Also suitable for other long run dies.

MINEOR 5% Chrome Air Hardening, Non-Deforming. Has many desirable features of more expensive air hardening steels. Tough at high hardness.

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"MT6" The Standard "M2 Type" High Speed Steel. Designed for a superior tool and at the same time save critical alloys.

There's a plus quality to a Darwin Tool Steel that makes it an outstanding value regardless of the type you buy. At left is a list of our steels—all are tops in their class—all will give longer service on the jobs each is designed to do. A call or letter will bring a sales engineer to help you save time and money selecting the right steel for your work.

Furnished in bar stock, billet, forging, sand casting. Drill rod, flat ground stock, tool bits. Bulletin on Request.

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ZIV STEEL & WIRE CO., CHICAGO • DETROIT • ST. LOUIS • INDIANAPOLIS • TOLEDO • MILWAUKEE • M. G. OPP COMPANY, NEW YORK CITY • PECK STEEL & DIE SUPPLY COMPANY, LOS ANGELES • CHARLES B. WEBSTER, PLAINVILLE, CONNECTICUT • CHARLES W. BRINGMAN, ORLANDO, FLORIDA

SEE ADVERTISERS INDEX, BACK OF BOOK, FOR INFORM-A-GRAM KEY NUMBERS

. . . Automatic, from page 47

position, while the other end holds a radial cutting blade. Provisions within this tool design can be made to hold either a drill or centering tool. Behind the radial cutting edge is the clearance, normally placed at 15°, and running away from the cutting edge is the 15° rake surface against which the chips press as they are turned off the stock. On the end of the bit is a clearance angle of about 15° which is between the tool and the turned body of the work. Knee tools taking light cuts usually do not require chip control. On work where a sharp cornered shoulder is not required, the pointed tip of the tool may be rounded slightly. This will give a bit longer life between grinds and will eliminate the acute point which is often the first to break down as the tip dulls.

Recessing and Knurling — Although the swing tool previously described performs recessing operations, an additional tool is available for this type operation; being operated by the forward movement of the turret. This tool will be discussed in greater detail in the discussion of producing the knurled washer.

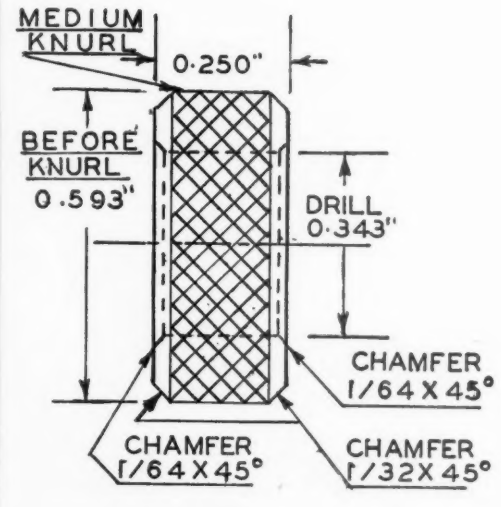
Knurling is a process where a series of ridges or diamond shaped heads are impressed on the surface of the work by the action of hardened steel rolls or knurls. The method of producing this knurl on the automatic will vary, thus: — (a) the adjustable knurl holder positioned in the turret is designed to produce straight, diamond or spiral designs from the end of the work piece; (b) the side knurl, activated from either the back or front slide positions, are used to knurl at some distance from the end of the work piece; (c) either the bottom or top knurl holders, the design of which permits the combination of both knurling and cut off, is activated from the back cross slide position, this design being used for knurling sections nearest to the collet of the machine; and, (d) the knurling swing tool, which is designed for use in the turret position, is employed under conditions where other designs are not practical to use.

In the production of the knurled washer, as is illustrated in Figure 13, five of the six turret positions and both cross slides are occupied. In this operation sequence, the previous mentioned operations of knee tool turning, recessing and knurling is performed. Since the knee tool does not provide any support for the work and the cutting pressures are not balanced, it is limited on short work pieces where there is little overhang. This tool is, therefore, a good choice since the section indicated has sufficient rigidity to

. . . *Continued on page 82*

Figure 13

Knurled Washer—

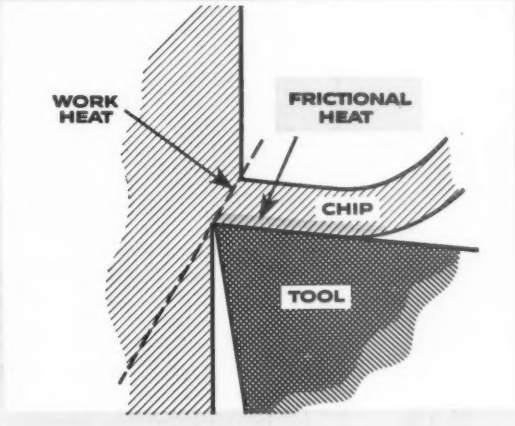


Material—S.A.E. 1120; 5/8" DIA.
Seconds to Make One Piece—13
Gross Production per Hour—277
Equipment—No. OGHS Brown & Sharpe Automatic Screw Machine

Spindle R.P.M. 1610 Rev.	Order of Operations and Tools	Feed per Rev.	Sur. Ft. per Min. of Oper.
11	Clear		
49	Turn #20A Knee Tool	0.007	264
14	Index Turret		
49	Knurl #20D Adjustable Knurl Holder	0.010 0.022	
14	Index Turret		
28	Center #20BA Floating Holder Form Front Slide		
14	Index Turret		
70	Drill #20BA Floating Holder	0.005	145
14	Index Turret		
28	Recess #20M Recessing Tool	0.0012	
49	Cut Off Back Slide Index Turret 2 Times	0.0015	
11	Feed to Swing Stop		
350			

JOHNSON'S WAX-COOL CUTS 2 KINDS OF HEAT!

The only coolant that effectively attacks *frictional* heat as well as *work* heat



Because of the greater lubricity of wax and its polar attraction for metal, Wax-Cool is the first coolant to greatly reduce frictional heat at the tool-chip interface. Wax-Cool also has the heat carry-off properties of ordinary coolants—to check work heat generated in the shearing zone.

Because Wax-Cool is the only water-soluble coolant that provides real lubrication between tool and chip, it has these advantages over other coolants:

1. **WAX-COOL** stays with tools and material even under high heat and pressure.
2. **WAX-COOL** prevents chip weld because work runs cooler.
3. **WAX-COOL** effectively minimizes *frictional* heat, which is by far the principal source of heat.

Here is proof!

Parts of a stud driving gun made of #4140 annealed alloy steel. Both parts machined on same turret lathe. Smooth finish shown at left resulted from Wax-Cool's greater lubricity. Rough, poorly finished part on right shows results obtained from ordinary coolant.

Here are Wax-Cool's other benefits:

- **Tool life almost doubled.**
- **Finish feed stepped up from .004 per rev. to .007 per rev.**
- **Speed increased from 300 R.P.M. to 680 R.P.M.**
- **Lubricant savings: approx. 50¢ per day.**
- **Eliminated problem of handling hot chips.**

A test is your best proof

In your own shop, Johnson's Wax-Cool can show you savings in tools and time plus performance standards you never believed possible. Call your local Johnson industrial distributor, or write to:

INDUSTRIAL PRODUCTS DEPT. TP7
S. C. JOHNSON & SON, INC., RACINE, WISCONSIN

Ask about Wax-Cut—*wax-type cutting oil for automatic screw machines, gear cutting machines, etc.*

Ask about Wax-Draw—*wax lubricant for drawing and forming all types of metals.*

A product of Johnson's Wax Research

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All-purpose magnifier for general shop use

Large 2X double convex precision ground lens folds into durable protective leather case. A popular, inexpensive model to carry or keep in desk or on bench. Only $1. See complete line of industrial magnifiers by this manufacturer, world-famous for optical quality and value. Stocked by leading industrial suppliers, $1 to $25. Bausch & Lomb Optical Co., 50419 Bausch St., Rochester 2, New York.

Write today for tell-all handbook and catalog, "INDUSTRIAL MAGNIFIERS, HOW TO CHOOSE AND USE THEM"

B&L BAUSCH & LOMB
Industrial Magnifiers

Square Carbide Inserts Reduce Machining Cost

Direct tool cost savings of approximately seven dollars per thousand parts produced plus additional savings resulting from minimized tool changing and grinding time was recently secured at a prominent Midwest-

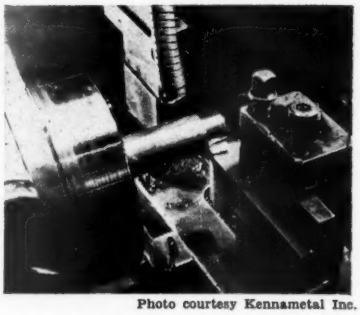

Photo courtesy Kennametal Inc.

ern manufacturer's plant by using indexable square carbide inserts for rough turning forged 321 stainless steel jet engine nozzles — at 1/20 of their previous tool cost.

Heretofore the operation was handled with a type of brazed carbide tools at 0.0045-inch feed, 150 surface feet per minute, and 0.093-inch depth of cut. Using these tools, the best life was 50 to 60 pieces per grind or a total of 640 pieces per tool. Under this setup, tool cost per piece was $0.0071 or 7-tenths of a cent.

Now, using Kennametal tungsten carbide square insert tools of style SBR-85 in grade K6, 325 to 350 pieces are turned per cutting edge at a feed of 0.003-inch per revolution. Depth of cut is 0.093-inch at 1480 revolutions per minute and 490 surface feet per minute. Lathe used in the operation is a No. 3 Warner and Swasey lathe powered by a 10 hp motor. With four cutting edges available on each end of the clamped insert, an average of 2700 pieces are machined between grinds. Since about 1/32-inch of stock is removed from each of the insert's ends in regrinding, estimated number of pieces per insert is 32,400.

In running a cost analysis on the use of the Kennametal tool, the producer found that with the tool holder being used for

the life of five inserts, tool cost per piece averages about 1/28 of a cent.

To turn 32,400 pieces with a brazed tool would have required approximately 50 tools at $4.55 each or a total tool cost of $227.50 or $0.0007 per piece produced.

Overlay Welding

A Universal welding machine for overlay welding the rotating bands on projectiles has been recently developed by an eastern manufacturer. It makes use of a standard welding head which uses a continuously consumable electrode. This head is adjusted easily with respect to the shell.

A diversity of rotating bands can be applied by either a spiral or index feed of the head while the shell is rotated between self centering chucking adapters. Complete versatility of speeds and feeds is provided. The welding generator is incorporated in the frame of the machine.

Compressed air or water cooling of the work is provided thru a cooling tube synchronized with the welding head. Automatic loading and unloading, after each shell is processed, makes the machine suitable for production line work. The consumable electrode can be of various metals which must conform to the shell specifications. These include iron and copper.

Simplified models which will not encompass such a wide range of shells and adjustments will be introduced to the market in the future. This principle of applying rotating bands is adaptable to projectiles manufactured by the Army and the Navy only if authorized in the Government specifications.

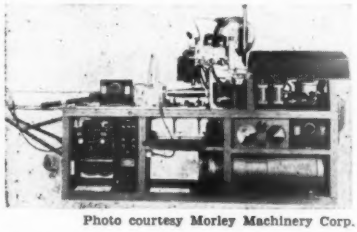

Photo courtesy Morley Machinery Corp.

This equipment is also adaptable to increasing the diameter of cylindrical parts by welding.

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NEW SLEWEK *ENGINEERED* FIXTURE CLAMPS

NEW FIXTURE COMPONENTS FOR YOUR TOOLING PROGRAM

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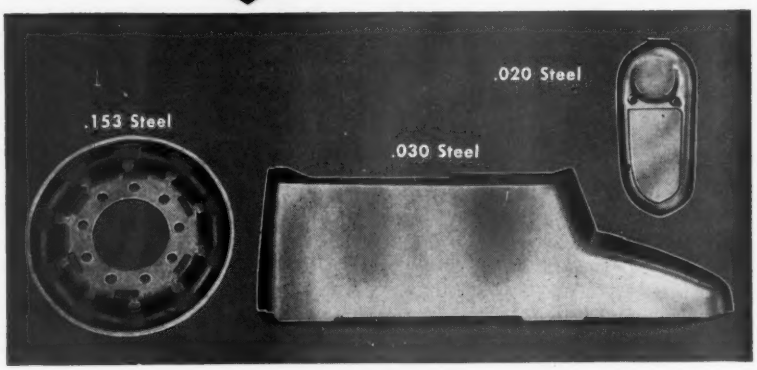


TRIMS SHELLS COMPLETE

Assures Clean, Flat Edges

Slow, costly, multiple "horn" operations, and distorted edges due to "pinch" trimming can be eliminated by a Brehm Die. Operating on principles different than ordinary trimming methods, the Brehm "Shimmy" Die with angular cams causes the shearing edges to cut *four ways* in a *single* press stroke.

Materials, thickness, shapes and sizes look alike to a Brehm "Shimmy" Die. Whether it's stainless or mild steel, copper, brass, zinc, gold, fiber, silver, aluminum, rubber or plastic, Brehm users are assured of precise production results. Shapes can vary widely, whether a watch case, artillery case, refrigerator door, automotive or aircraft part. Clean, flat, burr free edges are assured. Edge contours can be straight or curved, with multiple notches and projections.

When model changes alter the part design, or if you wish to handle an entirely new part, you only need to substitute cutting adapters.

Write today . . . for a free catalog. Find out what a Brehm "Shimmy" Die can do—submit blueprints, or the part for full information or quotation.

THE "SHIMMY" REG. DIE ® **Brehm TRIMMING DIES**

THE STEEL PRODUCTS ENGINEERING CO.

BREHM DIE DIV., DEPT. 16 SPRINGFIELD, OHIO

Turret Drilling Machine

The manufacturers of the revolutionary Burgmaster drilling and tapping machines, announces another adaptation of the standard Model 2A machine — the Burgmaster 6 Spindle Turret Drill, Flange Mounting Type, Model 2B. This model can be mounted on any type of base, in a variety of positions. It is designed so that two or more machines can be mounted on the same base at various angles in order that operations can be performed in different planes at the same time.

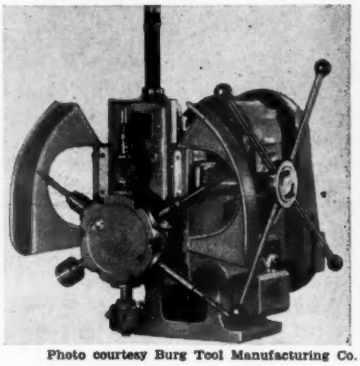


Photo courtesy Burg Tool Manufacturing Co.

The flange mounting machine is equipped with a separately mounted electrical panel and chain counterweight unit, and can be furnished with an automatic hydraulic feed. Spindle speeds, ram travel, feed handles, motor, and other features are the same as the present Model 2A. Other specifications featured in this machine are:

8″ spindle travel, 12 pre-selective spindle speeds, 225 to 3000 RPM, 4 speeds per spindle. 12″ throat depth. Maximum clearance from nose of No. 34B chuck to bottom of mounting flange in 8¾″. The center of the spindle to the first mounting hole on the flange is 12¾″. The size of the mounting flange is 15″ x 12″. Overall dimensions are — height 32⅜″, width — 40 11/16″, depth — 15″.

This Model 2B is designed to increase production, improve quality and lower production costs.

Increased Capacities for Boring Head

Two new models of the Wohlhaupter universal facing and boring heads are now available from the U. S. and Canadian distributor. These two new models make a total of nine sizes now available.

Photo courtesy Carl A. Nelse

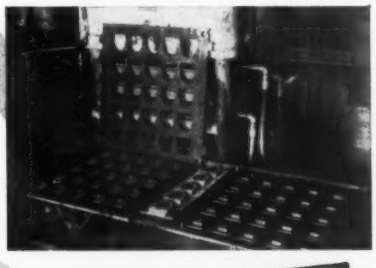
The Masterhead is applicable to boring mills, jig borers, radial drilling machines, lathes, millers and other machine tools as well as to production units. It can be used to great advantage for boring, facing, recessing, undercutting, taper and form turning and also for threading stationary work without reclamping. Users of heavier milling machines, will be interested in the new models UPA 6 and UPA 6-S7 not only because of their greater range and heavier construction, but also because of their high precision and versatility. The rigidness of the head permits heavy cuts under the most strenuous conditions.

All Masterheads have automatic feeds, end release and end return, adjustable stop, and are adaptable to all standard machines. The UPA 6 has a boring and facing range up to 31½" and the UPA 6-S7 up to 36¼".

SPEED CASE STEEL PLATE EASIER TO MACHINE

The Gro-Cord Rubber Co., Lima, Ohio, produces "puddle-proof" Neo-Crepe, Neo-Cork and Neo-Cord heels and soles of molded neoprene. They are widely used by manufacturers of footwear. Gro-Cord has speeded production and cut tool room costs by making their molds of Speed Case (X1515) low carbon, open hearth steel plate. Ease of machining has increased tool life nearly 200% — machining speeds and feeds have been increased up to 50%. Speed Case takes a "beautiful" finish — can be engraved more readily. Physical properties are such that no heat treatment is necessary in this instance — although many users praise the rapid, deep case which can be produced through several methods of case hardening.

The Speed Steels — Speed Case, Speed Treat and Speed Alloy can probably cut your costs or improve your product — get the facts!



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Built Like
Precision Dies

Question

can you
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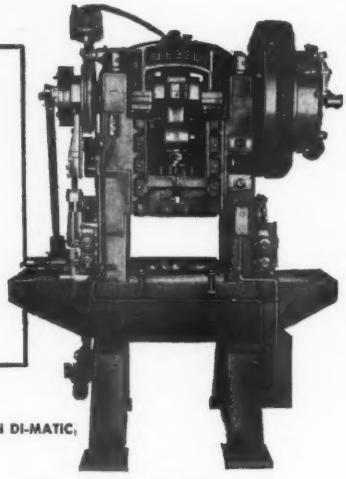
your
DIE life?...



40-TON DI-MATIC

Answer

Definitely yes—if you employ your dies in a press engineered with the dies in mind, a press designed to assure positive punch and die alignment, no press deflections, and negligible vibration and shock.

The life of any die—the quantity of stampings obtainable—is limited by a definite number of sharpenings. Increasing the number of stampings between grinds is the *only* way to lengthen die life.

The Diebel 40-ton DI-MATIC Press prolongs die life because of die conscious press engineering

- Cylindrically Shaped Ram, Precision Ground — guarantees perfect alignment of punch and die
- Crankshaft Supported by Four Bronze Bearings — assures greater press rigidity
- Keyed and Tie-Rod Frame Construction — eliminates press deflections
- Built-in Shock Absorbers — minimize vibration and die shock

also 5-TON
8-TON
12-TON DI-MASTER PRESSES

Investigate

DIEBEL

Precision-Built Automatic

PRESSES

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Di Machine Corporation 2708 W. IRVING PARK ROAD CHICAGO 18, ILLINOIS

Speeding-Up Paper Sheeting Operations

Installed in the basement, this long legged Portelvator increases production of a ground floor paper sheeting machine by providing the means of handling six foot stacks of paper at the delivery end of the machine.

Operated by a 2 H.P. motor, with reversing magnetic starter,

Photo courtesy The Hamilton Tool Company

limit switch, and overload protection, the table is push-button operated for a total vertical travel of seventy-eight inches. Table size is 48" x 84". Load capacity is three tons.

In operation, a skit is positioned on the platform of the Portelvator and the platform raised to maximum height, 30" above floor level. As sheets are received on the skid, the platform is lowered until it reaches its extreme low position, 48" below floor level, and then returned to floor level. The stock is then taken to storage.

Buying Directory

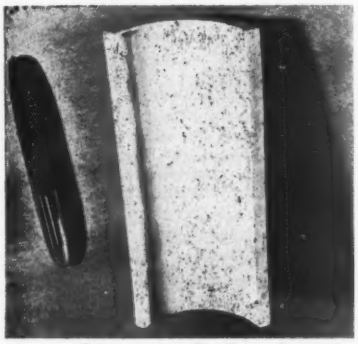
The Fourth Edition of the National Screw Machine Products Association's Buying Directory lists the facilities and services of all member companies, and also contains a Statement of Policy to Customers which has been subscribed to by all members.

Copies of the Buying Directory are available to all members and customers of the industry by writing to the National Screw Machine Products Association, 2860 East 130th Street, Cleveland 20, Ohio on your company letterhead.

Ultrasonic Waves for Cleaning Metal

A Detroit manufacturer of industrial cleaning equipment and chemicals, has announced the development of an advanced, practical method of metal cleaning through the use of ultrasonic waves.

The new method, known as the Detrex Soniclean Process, features an element for direct-



Photos courtesy The Detrex Corporation

Fig. 1. The ceramic transducer—heart of the new ultrasonic cleaning process—is shown above. Its size, focal properties and flexibility are considered far superior to natural quartz crystals used in previous ultrasonic cleaning processes. The ceramic elements can be connected in multiple units.

ing sound energy which opens the door to far-reaching advances in a wide variety of industrial fields.

By employing this new element in place of the quartz crystals previously used in ultrasonic experiments, the limitations caused by the size and properties of quartz have been overcome.

The use of ultrasonics for cleaning is not a new or revolutionary idea. Detrex laboratory technicians have been conducting such experiments for years, and more recently have concentrated their efforts in the search for a transducer far more flexible than natural quartz.

The element, jointly engineered by Detrex and the Brush Electronic Company, is a curved piece of ceramic resembling a six-inch-long pipe, cut in half along the longitudinal axis. The ceramic pieces, which can be connected in series and

. . . *Continued on page 70*

FOR *UNEQUALLED* PRECISION
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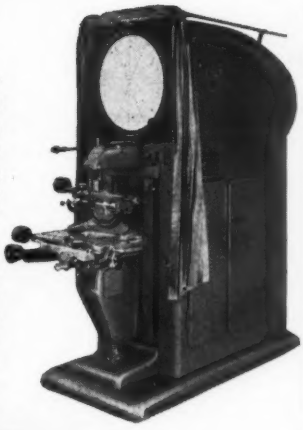

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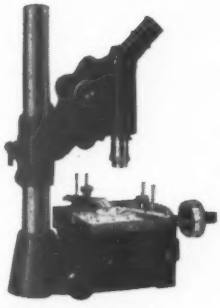

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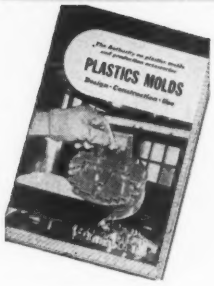

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. . . Ultrasonic, from page 69

arranged as desired, are designed to offer focusing and flexibility properties never before found in equipment of this type.

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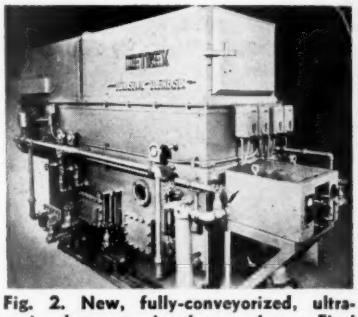

Fig. 2. New, fully-conveyorized, ultrasonic degreaser is shown above. Final cleansing of parts by the use of ultrasonic waves is incorporated in the regular degreasing cycle. The equipment shown here is more than six feet high and 12 feet long. Note high frequency generator at right.

ducer, converted into sound energy, and projected through a solvent at a frequency of 430,000 cycles per second. The solvent currently being used in the process is trichlorethylene; however, the process is not limited entirely to this material. Because a potential of only 40 volts is required to operate the ceramic transducers, they can be safely immersed directly in the solvent. This eliminates the complicated sealed containers that are required with other transducer materials and high voltages.

Material to be cleaned is placed in the solvent, either manually or by conveyor, directly in the path of greatest focal intensity of the ultrasonic waves. In this area an extreme turbulence is created, resulting in a deep and penetrating cleaning action that removes, almost instantaneously, all dirt, grease, chips and microscopic particles of soil from even the most intricately designed and close-fitting parts.

Because of the design of the ceramic transducer, the sound waves converge to a straight line as long as the transducer itself. The focal area in other transducers is confined to a single point.

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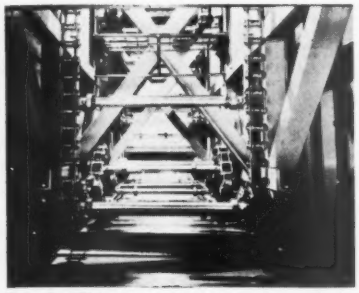

Fig. 3. This is an interior view of the fully-conveyorized, ultrasonic degreaser manufactured for the Electric Shaver Division of Remington Rand, Inc. Tray in the foreground can hold 50 shaver heads for ultrasonic degreasing. The removable trays have been designed for parts handling and easy stacking.

First commercial equipment employing the Soniclean Process has been installed by Detrex for the Electric Shaver Division of Remington Rand, Inc. Fully conveyorized, it is the largest commercial unit ever built for ultrasonic cleaning.

In cases where exceptional cleaning quality is required or where parts have fine openings, crevices and other hard-to-clean forms, the process is fast and economical. There are virtually no limitations placed on the type and kind of work which may be successfully cleaned by the Soniclean Process.

The work accessibility and generous clearances of the T-lathe design results in gaging operations being performed with corresponding ease, particularly on parts of comparatively large diameter and short length. Exemplifying this, is this turning of a jet engine part on a Lodge & Shipley T-lathe. With a large caliper made up of Webber heavy duty gage blades and accessories, the operator can check the OD without interference from the lathe structure.

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LOW TEMPERATURE TREATMENT OF METALS

by Watson N. Nordquist
Technical Editor

LOW TEMPERATURES (-120°F to -150°F) are now being successfully employed in industry for expansion-fit assembly of metal parts; for dimensional stabilization of tool, gage, and machine steels; for increased hardness and tool life; as well as for other applications yet in the experimental stage.

The low temperature treatment of steel is not a new subject. Cold treatment and processing of metals, as we know it today, first began in this country in the early part of the 19th century, as a laboratory operation. As a result of two wars and normal progress of industry, these processes have come to assume an important role in our general industrial picture.

At first, cold treatment was extremely limited in its use by industry for two primary reasons: one, the lack of suitable equipment to obtain adequate low temperature; and, secondly, a complete lack of basic knowledge regarding the effects of low temperature upon metals.

More and more applications within the metalworking, plastic, chemical, and other fields are turning up every day. Many of these are still in the experimental stage; but, the completion of these experiments and their practical application is talked of now in terms of months rather than years.

It was only recently that equipment suitable for everyday use — and capable of consistantly producing lower temperatures than those obtainable with dry ice — became commercially available. By means of these highly perfected mechanical refrigeration units, it is now possible and feasible to achieve continuous temperatures of -120°F, -150°F or even lower, and to achieve these temperatures economically.

It has long been recognized that conventional heat treatment frequently fails to develop a uniform structure in tool steels. In time, it was found that low temperature treatment of steels — when included in the hardening cycle — would produce a more stable structure and, in many instances, a greater hardness than could be experienced by previous methods of processing.

Effect on Molecular Structure

Investigations showed that when steels were subjected to extremely low temperatures results included (1) change in micro-structure, (2) higher magnetic values, (3) temporary shrinkage, and (4) permanent increase in volume. These results, however, varied in degree with different treatments, and it was apparent that each alloy and method must be studied separately.

At least steel and other ferrous metals were found to experience a definite molecular change when subjected to cold treatment. The change was accompanied by improved hardness and stability. These results had special significance to tool engineers. Because of increased hardness

The author acknowledges the valuable assistance given him by Bowser Technical Refrigeration, Terryville, Connecticut, in supplying source material and in review of the final manuscript.

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6	30-40-48-56-60
7	32-40
8	24-30-36-38-40-44-48
9	24-28-32-40
10	28-30-36-40-48-64
12	28-28-32-36
14	20-24-28
1/16	60-64
5/64	72
3/32	48
7/64	48-56
1/8	32-40
5/32	32-36-40
9/64	36-40
11/64	36
3/16	20-24-32
13/64	32
7/32	24-28-32
1/4	18-24-26-27-30-32-36-40
5/16	16-20-22-27-28-32-40
3/8	12-16-18-20-27-28-32-36-40-48
7/16	12-16-18-22-24-27-28-30-32-36-40
1/2	12-14-16-18-22-24-26-27-28-30-32-40
9/16	18-20-24-27-28-30-32-40-48
5/8	12-14-16-20-24-27-28-32-36-40
11/16	11-16-18-20-24-27-28-30-32
3/4	9-11-12-14-18-20-24-26-27-28-32
13/16	10-14-18-20-32
7/8	10-12-16-18-20-24-27-28-32
15/16	8-9-10-12-14-16-18-20-24-32
1	10-12-16-18-20-24-27-32-40
1-1/16	12-14-16-18-20-24
1-1/8	8-10-14-16-18-20-24-32
1-3/16	8-10-12-14-16-18-20-24
1-1/4	8-10-14-16-18-20-24-32
1-5/16	12-14-18-18-20-24-32
1-3/8	8-10-14-16-18-20-24
1-7/16	8-10-12-16-18-20-24
1-1/2	8-10-14-16-18-20-24-28
1-9/16	18-20-24
1-5/8	8½-8-10-12-13-16-18-20-24
1-11/16	10-12-14-16-18-20-24
1-3/4	8-10-12-14-16-18-20-24
1-13/16	8-10-12-14-16-18-20
1-7/8	8-10-12-14-16-18-20-24
1-15/16	8-10-12-14-16-18-20-24-28
2	4-1/2-8-10-12-16-18-20
2-1/16	12-14
2-1/8	12-16-20
2-3/16	12-16
2-1/4	4-½-8-12-14-16-18
2-5/16	12-18
2-3/8	12-16-18
2-1/2	8-10-12
2-9/16	18
2-5/8	12-16-20
2-3/4	16
2-7/8	8-12-16
3	8-16
3-1/4	8-12-16
3-1/2	8-12-16
3-7/8	8
4	8-12

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2	56-64
3	56
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5	40-44
6	32-36-40
8	32-36-40
10	24-30-32-40
12	24-28-32
1/4	20-28-32
5/16	18-20-24-28-32
3/8	16-24-32
7/16	14-20-28
1/2	12-13-20-28
9/16	12-18-20-24
5/8	11-12-18-20-24
11/16	11-16-24
3/4	10-16-18-20
13/16	16
7/8	9-12-14-18-20
1	8-12-14-16-18-20
1-1/8	7-12
1-1/4	7-12-16-18
1-3/8	6-8-10-12-16-18-20-24
1-7/16	8-10-12-14-16-18-20
1-1/2	6-8-10-12-16-18-20
1-9/16	8-10-12-16-18-20
1-5/8	8-10-12-14-16-18-20
1-11/16	8-10-12-14-16-18-20
1-3/4	8-10-12-14-16-18-20
1-13/16	8-10-12-14-16-18-20
1-7/8	8-10-12-14-16-18-20
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and its companion improvement in wear resistance, increased tool life was obvious. And, because of greater stability, smaller tolerances became possible on tools, gages and parts for precision assemblies, with further growth of steel being eliminated for all practical purposes.

Expansion Fit Method of Assembly

Probably the least controversial and, at the present time, one of the most useful applications of low temperature is that of expansion fitting, as a manufacturing process. There are many distinct advantages to expansion fitting over the older method of shrink fit, which requires the use of heat and force.

Before enumerating the advantages of the expansion fit process, the difference between expansion fit and shrink fit—as applied in industry to the insertion of one part into another—should be clarified.

The shrink fit method requires the part into which the male part is to be inserted to be heated to the temperature necessary for the required expansion; and, after the male part has been inserted, the expanded part upon cooling shrinks into place, thus deriving the name "shrink fit". In the expansion fit method, the opposite procedure is followed. Instead of heating the female part, the male part is cold treated or shrunk, then inserted into the female part, and allowed to expand into place as it returns to room temperature, thereby deriving the name "expansion fit".

Advantages of Expansion Fits

Among the advantages of expansion fitting are the following:

1. Freedom from oxidation scale, making subsequent cleaning and machining unnecessary, and thereby avoiding dimensional changes. It is also possible to avoid detrimental changes in the physical structure and properties of the material being expansion fitted.

2. Lack of distortion. Distortion was quite prevalent with the shrink fit method. The heat which is employed for shrink fits greatly increases the possibility of distortion, whereas cold has little effect on the form changes in the material being shrunk.

3. Ease and safety in handling cold parts and in cold treatment of parts, with no possibility of accident such as may occur when using heat to the degree necessary to make a shrink fit. It is possible in expansion fitting to use only **hand pressure** to insert a bushing or similar part, as against the necessity for a force fit or the use of an arbor press or other equipment in the shrink fit method.

4. Better mating of assembled parts than is possible with force or shrink fits. In the latter, it is usual to achieve only 50% mating of the two parts to be joined; whereas, with the expansion fit, up to 50% more mating surface — over and above the 50% possible with the force fit — is gained. Even though it is much easier to insert the bushing or part by expansion fit, the amount of pressure required to remove the expansion fitted part will vary from 5 to 10 tons more pressure than would be required with a shrink fit. This, of course, could possibly be a negative factor in some types of applications.

It is unnecessary to worry about the possibility of marring or changing the part dimensionally, and it is unnecessary to do any corrective machining following assembly. For these reasons, it is possible to final machine all parts before assembly. The completely finished bushing, bearing, or whatever it may be, is placed directly into the low temperature unit set for -150°F. The part may be left there for the designated time, which will be from 5 minutes to ½ hour, or even 2 hours, depending upon the particular metal, its size, and the amount of shrinkage required. Less severe temperatures (-90°F or -120°F) may

. . . *Continued on page 76*

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Julius Saloway

Robert T. Frisbie

Guy V. Bennett

T. G. Barnes

G. A. Wilson

Julius Saloway, for the past number of years, manager of the Liquidation Division of Morey Machinery Co., Inc., has been elected to the firm's directorate.

◆

The New Britian Machine Company has announced the election of Robert T. Frisbie Jr., as vice president, Frisbie previously had been sales manager of the machine tool division.

◆

Guy V. Bennett has joined the T. C. Jarrett Co., and will serve in the sales and engineering department of C. I. Hayes Inc. Bennett's affiliations include membership in the American Society for Metals and Sigma Tau, national honorary engineering fraternity.

◆

T. G. Barnes is now general sales manager of Firth Sterling Inc. A graduate of Virginia Polytechnic Institute, Barnes, previous to his new appointment, served as special assistant to the chairman and also as production manager. During World War II, he served as a Lt. Col. in the U. S. Army Corps of Engineers. Succeeding Barnes as production manager is G. A. Wilson, formerly general superintendent of the firm's Carbide Division. Wilson has been with Firth-Sterling since 1949 and previously was chief industrial engineer. He is a graduate of Georgia Institute of Technology and during World War II was a captain in the Army's Combat Engineers.

. . . . . MEN YOU SHOULD KNOW

Richard Y. Moss

Robert Shannon

Albert E. Whyman

John W. Young

D. G. Faust

E. W. Bliss Company of Canton announces the election of the following new vice presidents: Richard Y. Moss, manager of Canton division; Robert Shannon, manager in Hastings, Mich., and Albert E. Whyman, in charge of European operations.

◆

John W. Young, chief power plant engineer, has been appointed director of quality control at North American Aviation. Young has been connected with the aviation industry since 1929 and has been with North American and its antecedent companies since 1930.

◆

D. G. Faust, chief engineer of the C. A. Norgren Co., is a recipient of the Alfred E. Hunt Award. The honor was given to Faust because of his technical paper covering the special research techniques and laboratory equipment used in developing the Norgren Micro-Fog Lubricator. The paper was judged the best of the year in the field of lubrication and allied subjects by the American Society of Lubrication Engineers. The award is sponsored annually by the Aluminum Company of America in honor of Capt. Alfred E. Hunt, an engineer and one of the founders of the firm. Others receiving the award in recent years include Paul Galbreath, Tennessee Eastman Co.; K. L. Hollister, The Texas Company; William M. Schuck, Armco Steel Corp.; Charles L. Pope, Eastman Kodak Co. and Oscar Maag, The Timken Roller Bearing Co.

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. . . Low Temperature, from page 73

be satisfactory in some instances, but longer exposure periods will probably be required.

Although it is much easier and quicker to conduct this process in a brine solution within the unit, it is quite possible to do it in air. In the latter case, however, an increased length of time will be required to accomplish the same result.

Fit Specifications

Ordinary tolerances for the conventional force or shrink fit usually call for the male part to be approximately 0.001″, per inch of diameter, larger than the hole. For example a 5″ diameter bushing to be inserted in a larger body will be machined 0.005″ larger than the corresponding hole. A strong hydraulic press would then be required to assemble the parts. It was necessary to have the bushing that much larger than the hole, in order to get even 50″ mating or metal-to-metal contact after the bushing was pressed home.

These figures were formerly used in production of diesel engines by a large midwestern manufacturer; but, under the severe strain of industrial engine operation, this press fit invariably worked loose. The solution to this problem was to make the bushing 0.0055″ larger than the ordinary interference called for, then chill it at low temperature (-120°F) so as to require a very slight press, which was accomplished with a hand arbor press. At -150°F there would be 0.001″ more shrinkage than obtained at -120°F. This additional shrinkage would enable insertion of this same bushing by hand.

As the part warms back to room temperature, it expands evenly resulting in a very strong metal-to-metal contact around its entire outer surface. Assemblies of this nature have withstood as much as 60,000-lb pressure — tons more than any force fit or shrink fit would take.

With the use of -150°F refrigerating units, cold treatment can be applied successfully to the expansion fit of fractional diameter parts. This means a practical application for the automotive and other industries where thousands of small bushings and bearings can now be dropped into place, thus facilitating the saving of thousands of man-hours now spent forcing parts into place. Experiments have also been successful with oil-bearing bushings in fractional sizes. The extreme cold immediately jells the oil so that it is not affected by the brine. Similar results could be achieved without liquid, but it requires a longer time.

A secondary but highly beneficial result of cold treating steel bushings for an expansion fit is the superior finish acquired in the bore. This comes from the refining action the chilling has on the steel, just as low temperatures are used to specifically improve the machining and wearing qualities of many steel parts and tools.

Dimensional Stabilization

One of the most vital timesaving applications of cold treatment of metals is the fast dimensional stabilization which permits permanently holding tolerances as close as two micro-inches. This is extremely important in the manufacture of gages, precision instruments, and many other products.

Dimensional changes normally result from slow metallurgical transformation within a quenched steel, wherein one constituent or phase (austenite) changes into another phase of different crystal structure and volume (martensite).

Previously, when fabrication called for 0.0001″ tolerance, parts so limited had to be aged by exposure to the weather for many seasons. This aging process was costly and necessitated large inventories of slow-moving materials. Also, there was a constant danger of stocks

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becoming mixed up, with subsequent doubt as to true age of an individual bar or blank. With the advent of the low temperature treatment, accelerated aging became feasible and was adopted by some to eliminate the time and expense incurred with previous methods.

In quenched steels, the austenite phase is retained in various degrees, being largely dependent upon composition and mode of heat treatment. This austenite transforms very slowly to the second or martensite phase, requiring months to years at room temperature to achieve nearly complete transformation. The rate of transformation decreased progressively, and 100% transformation may possibly never be achieved.

Because of the great need in Industry for additional data on the subject of Low Temperature applications, TOOLING & PRODUCTION invites its readers to describe THEIR experiences on applications, methods, and results. Address:
TOOLING & PRODUCTION
1375 Lee Road
Cleveland 18, Ohio.

Transformation results in dimensional growth and warpage to equalize normal stresses set up by the volume change. In all steels the austenite can be transformed by tempering, but frequently such high temperatures are required as to effect a loss in hardness of martensite and cause transformation of the austenite to a softer product, bainite.

Cold treatment accelerates this transformation to where gages and tools may be "equipped" in a few hours or days to permanently retain the necessary degree of accuracy, as compared with previous aging methods taking from many months to many years. Low temperatures reduce the stability of the retained austenite, that is, reduces its reluctance to transform.

Increase in Volume

Since the transformation of the steel structure is accompanied by an increase in volume, the chilling should be scheduled before final finishing. This slight growth can then be removed and the part will be completely stable. Recent tests on plug gages indicate that, even after many years of room-temperature aging, dimensional instability still exists, and low temperature treatment apparently is essential.

For example, some plug gages had worn under-size on the front end, and in some cases had actually increased in size at the opposite end. A -160°F treatment from 5 to 15 hours increased the size of several of the gages to from 0.00005" to 0.00008" per inch of diameter, or more than enough to refinish to standard size again. There was also an increase in hardness of from two to three points on the Rockwell "C" scale. This is particularly noteworthy because these gages were made before World War I and had approximately 30 years of room-temperature aging prior to this cold treatment.

Gage Block Processing

For **maximum** transformation of retained austenite, carbon steel and low alloy steel are cooled to -250° to -260°F. For the **required** dimensional stability in most types of gages, including precision gage blocks, temperatures need only range between -120° to -150°F.

Since high degrees of stability are not usually required for ordinary gages and machine parts, it would probably be sufficient to cycle these parts in the low temperature unit one or two times. However, if more stability is required, it would be advisable to use a five or six cycle treatment.

Commercially, the most complete transformation is required in the case of precision gages and gage blocks. The gage steel commonly employed is SAE-52100, a high-carbon chromium steel. Before the cold treatment method of stabilization

. . . *Continued on page 92*

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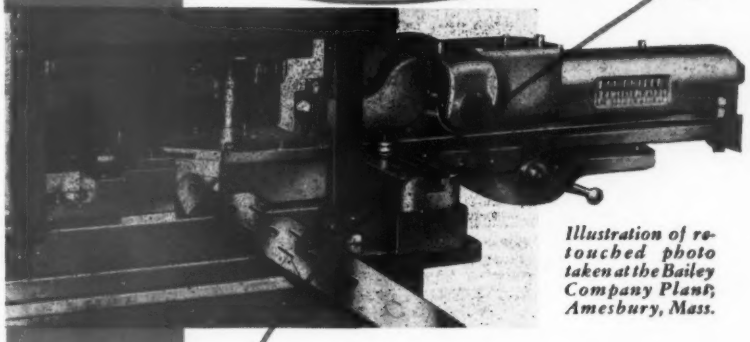

Illustration of retouched photo taken at the Bailey Company Plant, Amesbury, Mass.

As a result of their initial experience, when The Bailey Company, Amesbury, Mass., decided to equip the balance of their presses, Rol-Di-Feeds were selected.

States MR. H. W. POTTLE, *Chief Engineer*, "We are completely satisfied with the Dickerman Rol-Di-Feeds we have in service, as proven by our repeat orders. Our die setters who constantly use this equipment comment enthusiastically on its ease of set-up and accuracy."

Whether your operation is blanking, or producing parts from a compound or multi-station progressive die, the Rol-Di-Feed will do the job, reduce your costs and increase your production.

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According to Brooks & Perkins engineers, magnesium sheet can be stretch-formed into compound curvatures with aid of selective heating of the sheet by torches. A fiberglas blanket is placed between the cold die and the heated sheet.

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Thread rolling has some inherent advantages over chip-removing methods. Material rolled "flows" ahead of the tool to the full depth of the thread and outward into the thread form, eliminating any break in grain structure at crest of the thread. Result is a highly densified thread surface, wear-resistant, strong, and exceptionally smooth. The Fette self-opening thread rolling head permits threads to be generated at speeds equivalent to those used for turning the same material with h.s.s. tools.

High speed routing and contour milling of stacked aluminum sheets can be done efficiently . . . without the annoying, pungent fumes of the commonly used lard oil and kerosene lubricant. North American Aviation developed and is using a non-smoking, non-fuming lubricant.

Fast plunge or traverse grinding of small parts, in short-run or production lots, can be accomplished with the speed and precision common to modern heavy machines but with lower machine investment, on a new simplified cylindrical grinder. In addition to many other provisions for heavy-machine performance, the grinder features a Pope wheel spindle incorporating extra-large SKF double-row cylindrical roller bearings to ensure smooth, chatter-free finish and long operating life.

To drill glass compositions, use (hard grade) carbide-tipped or solid cemented carbide drills at relatively high speeds and low feed, and use kerosene for a lubricant.

A new circular calculator permits fast, accurate determination of practically all data required in laying out a set of cams. Two logarithmic scales revolve around a central pivot pin. Unlike the ordinary slide rule, this calculator gives the answer directly to the correct decimal place and eliminates inaccuracies due to mental calculations. Among the many possible applications, are the finding of required rpm, production time for threading or tapping, cutting sfpm, total spindle revolutions required for production time, gross production, and so on.

Carboloy has expanded its line of solid cemented carbide inserts for mechanical tool holders to include several new sizes and new shapes.

. . . put up by W. N. ("Doc") Nordquist, Technical Editor

Aluminum has always been a problem child, so far as efficient cleaning was concerned. Solvent type cleaners carry an element of fire risk; chlorinated degreasers are toxic and expensive; emulsion type cleaners do not always clean thoroughly and usually leave an oil film; in general, alkaline cleaners etch or tarnish the aluminum and may have adverse effects on other metals being cleaned in the same cycle. Careful consideration should be given to Vantrol 5541, an entirely new alkali-type formula, which has none of the disadvantages of previous cleaners. It is so powerful that spray washing is successful even on heavy cleaning. It is non-inflammable, non-toxic, cleans thoroughly and quickly, and does not etch or discolor aluminum or other common metals. It offers good or complete rust protection on most metals and leaves no scaly deposits.

Tool steel producer has reported that very minute grinding cracks in hardened steel rolls (5% chromium air-hardening steel) can be removed by careful use of grinding wheels of very coarse grit with soft binder, taking a maximum cut of 0.0005"/pass.

Some of the high-strength alloys, the Hastalloys for example, in sheet form are preferably cold worked due to the very limited temperature range in which the metals may be successfully hot worked. Work-hardening characteristics usually demand a full anneal between draws or forming operations. General practice is to form to within 10% of the finished dimensions, anneal, pickle, and then finish form to size.

Long-life ball mills, with tungsten carbide lining, are now available, up to 12" ID x 15", for manufacture of fine abrasive powders.

Experimental and short-run quantities of dished sheet and plate metal parts are effectively turned out by machine hammering, using a rapidly reciprocating upper tool (2800 strokes/min.) that continuously deforms the metal while the work is being moved under it. Secret of obtaining the smooth finish, that compares favorably with spinning, is the high speed of the upper tool.

To straighten or flatten engraved, embossed, or finished products of sufficient length, run them between straightening rolls on two moving neoprene belts of substantial thickness. The neoprene will offer complete protection for fine surface details.

Machinability of abrasive casting surfaces can be greatly improved by pickling the as-cast or annealed parts, according to the report made by O. W. Boston and Joseph Datsko before a recent ASME meeting. Both electrolytic salt bath and acid pickling give remarkable results.

An American corporation is being set up to assist in the engineering problems faced by industrialists procuring or using the famous Schiess heavy machine tools. Assistance will be offered in the selection or design, installation, use and servicing of these German-made machines. A complete parts replacement service also is planned.

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?? ARE YOU IN TROUBLE WITH THE F.C.C. ??

Many satisfied owners of induction heating, dielectric sealing, and electric welding equipment may be due for an unpleasant surprise in the very near future. Their equipment may be completely satisfactory to them —but not to the Federal Communications Commission. They might have to shut their equipment down, at least temporarily, or be in serious trouble. That is the conclusion to be drawn from a recent F.C.C. announcement.

When operating, a number of these devices emit radio frequency energy upon frequencies which the F.C.C. must keep clear of interference. This problem has been becoming more and more acute, especially since the advent of widespread VHF & UHF television. Accordingly, it is very likely that those plants using offending apparatus will receive notification to remedy the condition **at once** or face the consequences of violating a federal regulation. In addition, manufacturers of such equipment will probably find themselves in difficulty with their customers. While their current models may comply with F.C.C. requirements, earlier but still very serviceable equipment of their manufacture may not.

The crack-down is due to take place beginning June 30th, the F.C.C. has indicated. Many offenders have already been located and patrolling mobile monitors with direction finders are finding more all the time. In Part 18 the F.C.C. states quite broadly who may be affected:

"The operation in the industrial, scientific and medical service, of medical diathermy equipment, industrial heating equipment and miscellaneous equipment of a type which emits radio frequency energy upon frequencies within the radio spectrum constitutes a serious source of interference to authorized radio communication services operating upon the channels of interstate and foreign communication unless precautions are taken which will prevent the creation of any substantial amount of such interference."

A number of warnings have been given by the F.C.C. to violators of Part 18. Leniency has been shown and extensions have been granted. Some offenders are continuing operations in the hope that further extensions will be given. Others are counting on the time given by an extension to make adjustments, when and if the F.C.C. notifies them. However, this course is ill-advised at best, for F.C.C. Public Notice 85968 states:

" . . . Accordingly, all interested persons are advised that the commission has no present intention of adopting any further general extension of the terms for compliance with the applicable portions of Part 18 of the Rules beyond June 30th, 1953."

Obviously those affected by the F.C.C. ruling must seek a solution. In some cases, modification of the equipment in use may provide the answer — or the purchase of new equipment which does not cause interference. Either of these courses may be very costly and time-consuming, especially in larger installations. Of course, the equipment might be shut-down

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for good, but this is hardly feasible. The remaining method of compliance is to prevent the radiation of any appreciable amount of r-f generated outside assigned frequencies. The F.C.C. puts it this way:

". . . A well-designed shielded space or room may be expected to reduce substantially or eliminate such interference."

But "well-designed" does not mean that just any shielded room is sufficient. It must be tested and certified before it may safely be depended upon to meet F.C.C. requirements. Construction of such a room or enclosure requires considerable knowledge of the problems involved and might well be somewhat risky. Faulty design or construction would result in an inefficient enclosure, representing useless expense. In addition, the cost would probably be greater than that of commercially produced units. It is very likely that it would not pay to experiment.

A low cost shielded enclosure specifically designed for this purpose has just been announced by the Ace Engineering & Machine Company. Made up of standard size panels framed in white pine with galvanized steel screening stretched across the outer surface, it may be easily erected, taken down, or enlarged. Virtually any kind of electrical or mechanical power, water, gas, or other service can be brought into the enclosure. Tested by an independent laboratory, its attenuation is at least 40 DB, even under the most adverse circumstances. The most inexpensive commercially produced enclosure, it permits compliance with the F.C.C. requirements at lowest cost and with least time wasted.

It is imperative that shops and factories employing induction heating, dielectric sealing and electric welding equipment be certain that their installations do not violate Part 18 of F.C.C. Rules and Regulations. As a free public service, an official copy of Part 18 will be sent upon request by the Ace Engineering and Machine Company, 3644 North Lawrence Street, Philadelphia 40, Pennsylvania.

FOUNDRY COSTS MANUAL

Gray Iron Founders' Society, Inc., Cleveland, Ohio, released to members advanced methods for determining foundry costs in the core department. The revised method is contained in a seventeen page booklet entitled "Advanced Cost Methods for Gray Iron Foundries" and is one of a series of four publications which are being released as preprints of the forthcoming Cost Manual No. 2. Two previous preprints already issued described advanced cost methods covering "Melting Department Yield Tables" and "Molding Department." The fourth preprint on "Cleaning and Shipping" will be ready for distribution soon.

A. E. Hageboeck, Frank Foundries, Inc., Moline, Illinois, Chairman of the Society's Cost Committee and under whose jurisdiction the work is being done, stated that while the preprints are intended for members only and have limited distribution, Cost Manual No. 2 when finally released will be available for general consumption at a nominal cost. This manual will supplement Cost Manual No. 1, now universally used.

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. . . Automatic, from page 62

resist deflection under cutting forces. In addition, the work is short, the cut is comparatively light (1/64"), and the finish requirements preparatory to knurling are not exacting. Clearances between the turret position holding the knee tool and the slide positioned tools are not of importance in this job since both cross slides are withdrawn during the turning operation.

The adjustable knurl holder is employed in the operation illustrated in Figure 14. Two precautions are required in this operation. The first is to determine whether the knurls are in good condition and of the same diameter. The second precaution is to adjust swivels in the holder to obtain a 37½° angle with the axis of the work piece in producing the required diamond knurl.

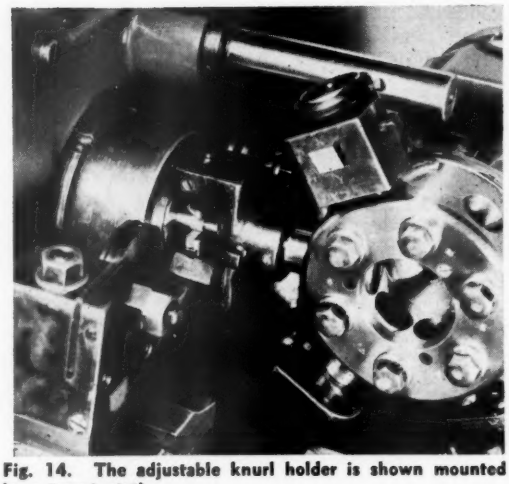


Fig. 14. The adjustable knurl holder is shown mounted in a turret station.

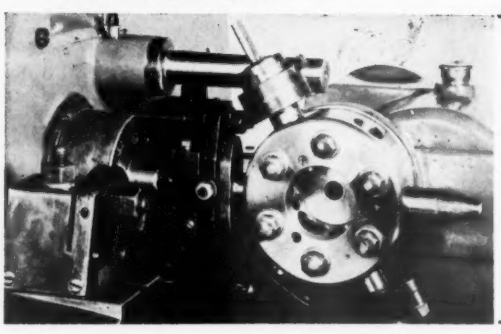
The chamfer on the turret end of the work piece is produced by the center drill. The chamfer on the opposite or spindle end must be machined with a recessing tool before the cut-off operation. As is indicated in Figure 15, the bit of the recessing tool is inserted through the drilled hole and at the desired position is advance to the hole wall to turn the groove. The bit, mounted axially in the tool, enters the hole in the work piece without touching any part of the work; the forward motion of the tool being halted at the desired location of the groove. This is followed by an immediate vertical movement of the bit which advances the cutting tool into the work, as is illustrated also in Figure 15. This pivoting action of the tool bit into the work produces the recess or groove which results in a chamfer after cut-off has been completed.

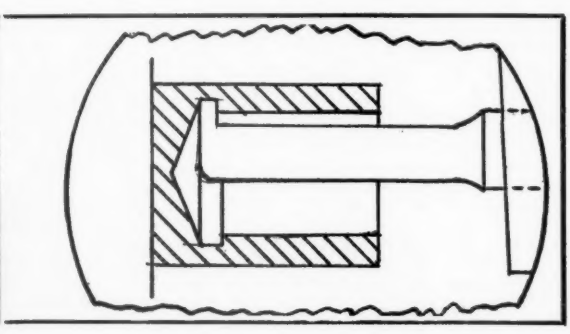
Centering and Facing Tools—This type of tool is similar to the knee tool previously discussed with the exception that the blades cut tangentially very similar to that of a box tool. As its name implies, this tool faces off the stock to the required length and centers it at the same time. This turret tool is employed when all turret positions are filled so that a stock stop, facing tool and center drill have no positions. The tangential facing tool or blade is set at an angle of 8° with the face of the spindle; this position angle being fixed by the slot in the tool body. The cutting edge is adjustable; the normal 16° rake employed being obtained by grinding a 24° angle on the cutting blade, inward and toward the turret side.

A fluted centering tool of comparatively large diameter is usually employed in the holder, the included angle of the point being less than the included angle of the drill that follows. In this tool type, particular attention must be given in grinding and setting the centering tool to see that the point is central with the work.

. . . *Continued on page 112*

Fig. 15. A recessing tool is shown mounted in a turret station. The bit of this tool is inserted through the drilled hole and at the desired position is given a vertical movement which advances the cutting tool into the work to form the required groove.





High-Speed Broaching Machine

The new Lapointe electro-mechanical drive horizontal broaching machine is described as "the most outstanding development in broaching since the origin of broaching itself, more than fifty years ago". Broaching speeds up to 300 fpm and more not only provide greatly increased production, but the machine produces a better finish while at the same time providing greater accuracy through freer cutting action.

Carbide-tooth broaches can be used at these high speeds to broach many jobs that heretofore were impossible of broaching.

Optional features are dual speed and dual cycle. The dual speed feature permits the machine to be operated at two or more pre-determined speeds for the same broaching stroke. Dual

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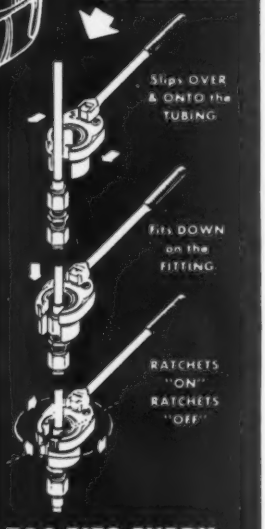

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cycle is the exclusive Lapointe development that has been designed for the successful broaching of jet engine components without requiring tool change-overs for the accuracy required. Limit switches are used for operating these dual speed and dual cycle features.

A very large main driving gear, herringbone type, drives the massive slide, riding on phenolic ways. The main slide is adjustable, guided and supported throughout the entire stroke.

Two slide widths are offered, 16″ and 24″, with strokes up to 180 inches. Drives up to 200 ph can be had, depending on the speed desired and the amount of material to be removed.

The need for skilled operators has been substantially reduced, due to such features as the simplified electric controls. These are completely flexible for setting-up purposes, and have a locking attachment to prevent damage to machine, tools or operator when automatic cycle is used. Safety of the operator has been a chief consideration in designing this high-speed broaching machine. Cutters are at eye level and can easily be examined at any time; maintenance is simplified because everything is accessible; the machine is fitted for hoist attachment.

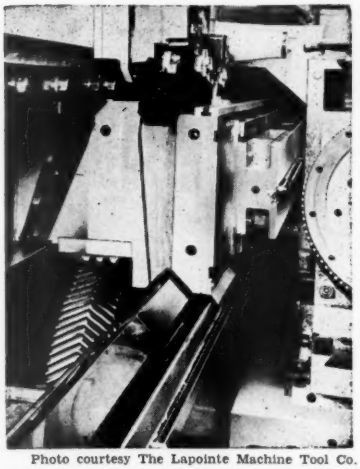

Photo courtesy The Lapointe Machine Tool Co.

Fig. 1 Broaching speeds up to 300 fpm, and more, are now possible with the electro-mechanical drive broaching machine which has a massive main slide driven by a continuous teeth herringbone bull gear and rack.

Fig. 2 Limit switches for dual speed and and dual cycle operation, shown here, provide flexibility and versatility for this broaching machine.

Two types of work tables are available for the machine. It is equipped with either the In-and-Out Table, or with the outstanding Lapointe Tip-Down Table. Indexing fixtures or other special work holding units can be adapted to the table.

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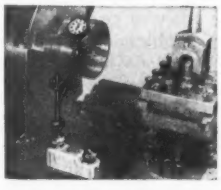

Model 160 being used to indicate workpiece on engine lathe.

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NEW! 3-step universal rod for all indicators. Sizes ⅜", ¼" and 5/16" diameters.
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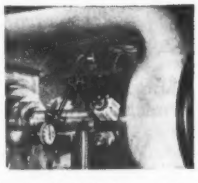
Offset clamp rod for lug back indicators.

NEW, SUPERIOR TINY-TITAN No. 100



Model 100 being used to align fixture in production mill.

★ All materials and workmanship unconditionally guaranteed.

NEW! 3-step universal rod for all indicators. Sizes ⅜", ¼" and 5/16" diameters.
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NEW! Sure-grip non-breakable tenite plastic case 1¼" wide, 1⅝" long and 1½" high.
NEW! Fool proof adaptor allowing 360° adjustment in all directions.
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Describing TINY-TITAN complete new line, Including:

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4520-26 W. Fullerton Ave., CHICAGO 39, ILL.

Order from your mill supply dealer or send order with name of your mill supply dealer

Keep Informed • CATALOGS BULLETINS • SPECIFICATIONS

PUBLICATION

A New 48-Page Catalog describing nearly 800 carbide tools has just been issued by the Nelco Tool Co., Manchester, Conn. Highlighted in the brochure are Nelco's line of milling cutters, drills, arbors, grinder-lathe centers and tools with photographs and specification drawings.
Circle Inform-A-Gram No. B1.

A New Booklet describing the application of air and hydraulic power is being distributed by Rivett Lathe & Grinder, Inc., Brighton 35, Boston, Mass. In it is displayed a condensation of the complete line of over 400 valves and cylinders and how they replace manual operation.
Circle Inform-A-Gram No. B2.

▲ Checking a roller to .000020" on taper, diameter and out-of-round in reciprocating fixture with Par-Ac gage head.

◀ Centering a race within .000020" before grinding. Indi-Ac electronic indicator shows runout as work rotates.

INDI-AC and PAR-AC GAGES Help the TIMKEN Company Make Bearings to .000075" Maximum Runout

TIMKEN "Double Zero" tapered roller bearings are produced with a maximum runout of only .000075" (*75 millionths*). This means that the factors producing runout must be held to .000025" or less in races and rollers.

Working to such accuracy on a production basis calls for unusual methods—and for highly-sensitive gaging equipment that is rugged . . . dependable . . . fast-acting . . . and easy to set up and read. To meet these requirements, Timken Company engineers chose Indi-Ac and Par-Ac electronic gaging equipment.

Indi-Ac Electronic Indicators are used

- in centering races to .000020" runout of the OD, for setting up to grind the ID concentric.
- in spot-checking and 100% final inspection of finished races, to see that the faces are parallel, the taper square with the faces, and the ID and OD concentric—all within .000025".
- in final inspection of all assembled bearings, for flatness or parallelism and for runout—both within .000075".

Par-Ac Production Gage heads and amplifiers are used

- at the machines in production inspection of rollers after grinding, for diameter, taper, and out-of-round within .000020".
- in 100% final inspection of rollers as above—and for sorting the rollers by diameter in increments of .000020".

Whether or not *your* tolerances are as close as these, Cleveland Electronic Gages can serve you well in the shop, toolroom or gage room. Write for bulletins on the Indi-Ac and Par-Ac —and on the Micro-Ac (reads .000001" per division).

P.S. Timken's production methods on "Double Zero" bearings are described more fully in an article reprint. Want a copy?

Designed, developed and manufactured by

CLEVELAND INSTRUMENT CO.
Formerly Graham-Mintel Instrument Co.
739 CARNEGIE AVE. CLEVELAND 15, OHIO

Small Lot Stampings are described in language that any man can understand in the new fully illustrated catalog issued by Duplicon, Inc., Westboro, Mass. In the pamphlet, Duplicon explains how they have helped many industries with inexpensive stampings.
Circle Inform-A-Gram No. B3.

A Plastics Injection Molding Machine is the theme of a colorful brochure offered by Lewis Welding & Engineering Corp., 53 Interstate St., Bedford, Ohio. The booklet includes the machines specifications and capacities which are listed for quick references.
Circle Inform-A-Gram No. B4.

Marking Devices and Equipment are described in detail in a new booklet presented by Newark Stamp and Die Works, Inc., 203-205 Market St., Newark 2, N. J. This catalog is well indexed so that you can turn quickly to the right page to find the answer to your particular marking problem.
Circle Inform-A-Gram No. B5.

Sealed Beam Utility Work Lamps are now available through Robboy Electric Mfg. Co., 2062 East 70th St., Cleveland 3, Ohio. Information on various models plus instructions on how to use new-type lamps is yours for the asking.
Circle Inform-A-Gram No. B6.

Application Information on Colmonoy 6, a versatile, all-purpose hard-facing alloy, is now available in a pamphlet (No. 104) by Wall Colmonoy Corp., 19345 John R. St., Detroit 5, Mich. Typical uses for Colmonoy 6 also listed.
Circle Inform-A-Gram No. B7.

Molykote Lubricants are described in technical detail in Bulletin 100 now offered by Alpha Corp., 179 Hamilton Ave., Greenwich, Conn. Included in the catalog are the various industrial grades and compositions of the lubricant.
Circle Inform-A-Gram No. B8.

Titanium promises to become one of our most important structural materials. In a new technical booklet, "Properties of Titanium and Titanium Alloys," Mallory-Sharon Titanium Corp., Niles, Ohio, provides current information on different production methods, general properties of various alloys, standard production classifications, testing procedures and specific qualities of the five types of titanium and its alloys supplied by the company.
Circle Inform-A-Gram No. B9.

PREVIEWS

Circle postage-free Inform-A-Gram Key Number for your request

Furnace Brazing for assembling metal parts on a production basis calls for a wide variety of carbon supporting "boats" or trays to hold parts in place before the brazing material solidifies. A number of typical brazing "boat" designs are illustrated in Catalog 40A just issued by Stackpole Carbon Co., St. Mary's, Pa.
Circle Inform-A-Gram No. B10.

Cold Chisels and 6 styles of steel punch are new products revealed in a new brochure now available from Billings and Spencer Co., Laurel St., Hartford, Conn.
Circle Inform-A-Gram No. B11.

Just Off The Press is the new Foredom catalog fully illustrating the company's line of flexible shaft machines, handpieces and accessories. Copies available by writing to Foredom Electric Co., Dept. 000, 27 Park Place, New York 7, N. Y.
Circle Inform-A-Gram No. B12.

Practical Features and applications of the Profilometer for measuring surface roughness are reviewed in the latest bulletin of the Micrometrical Mfg. Co., 345 S. Main St., Ann Arbor, Mich. Described are operating procedures and the "how and why" of the intruments versatility.
Circle Inform-A-Gram No. B13.

Heli-Coil Corp., 1321 Shelter Rock Lane, Danbury, Conn., announces the availability of a bulletin (No. 661) on wire thread inserts. The circular explains how wire thread inserts of stainless steel or phosphor bronze protect tapped threads.
Circle Inform-A-Gram No. B14.

Flywheel Ring Gear Teeth are automatically deburred and chamfered at the rate of 20 teeth per second on the Model 2029 Burr-Master. A new bulletin on the application and workings of this machine available from Modern Industrial Engineering Co., 14230 Birwood Ave., Detroit 4, Mich.
Circle Inform-A-Gram No. B15.

Schuler Machines are installed in all parts of the world. A brochure on these mechanical presses for sheet metal fabrication, forging and other operations gives a representative cross-section of the German company's extensive range. The bulletin is being distributed by United Machinery Sales Co., 2351 N. St. Louis Ave., Chicago 47, Ill.
Circle Inform-A-Gram No. B16.

Federated Metals Division has published a 4-page bulletin describing a new rosin core solder. The brochure gives five ways in which the new rosin core solder is superior to the ordinary rosin core solder. Copies can be obtained from Federated Metals Div., American Smelting and Refining Co., 120 Broadway, New York, N.Y.
Circle Inform-A-Gram No. B17.

The New S-P Hydraulic Cylinder line is presented in a recently released catalog by the S-P Mfg. Corp., 12415 Euclid Ave., Cleveland 6, Ohio. The brochure also furnishes engineering data that are sufficiently comprehensive to be of real value to machine designers, production and maintenance engineers and purchasing agents.
Circle Inform-A-Gram No. B18.

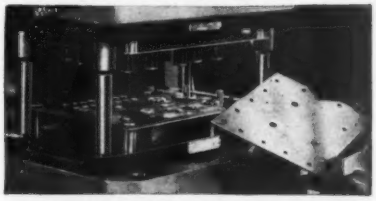
New • Fast • Proven

LOW COST methods for PERFORATING and NOTCHING SHEET METALS

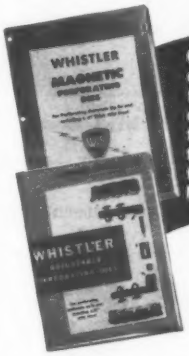
REDUCE DIE COSTS

All units and parts are interchangeable and used repeatedly in different arrangements. **INCREASE PRESS PRODUCTION**—*Down time is minutes as compared to hours for change-over.* For precision work in all types and sizes of presses. **START PRODUCTION AT ONCE.** Pierce materials up to ¼" thick mild steel. Standard sizes and shapes available up to 3 inches. Special sizes to order.

Whistler *MAGNETIC* Dies at work in large inclinable press. Magnetized retainers hold the units. No bolting required. A fast, economical method in making up a punch and die set for short or long runs. All parts re-usable.



Whistler *ADJUSTABLE* Dies on perforating and notching job, using Tee slotted die set. With Whistler Adjustable Punch and Die units production starts within hours instead of weeks. Last minute job changes made quickly.



● Here are the complete details with prices and application illustrations. Send for these catalogs. No obligation.

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Rotary Broaches and thread-cutting broaches are explained in literature offered by Shearcut Tool Co., Box 746, Reseda, Calif. A new technique in machining methods as a result of the recently developed tools is discussed.
Circle Inform-A-Gram No. B19.

Dial Bore Gages that can be inserted into work at an angle are the subject of an informative brochure offered by Boice Mfg. Co., Staatsburg, N. Y. Specifications and gaging aid also discussed.
Circle Inform-A-Gram No. B20.

Performance Records are included in a new booklet on recirculating heat treating furnaces just released by Dispatch Oven Co., 619 S. E. 8th St., Minneapolis, Minn.
Circle Inform-A-Gram No. B21.

Efficient Production With Precision of duplicate parts is made possible with the 2-H South Bend Turret Lathe. Data on this machine and its attachments and accessories available from South Bend Lathe Works, 425 E. Madison St., South Bend 22, Ind.
Circle Inform-A-Gram No. B22.

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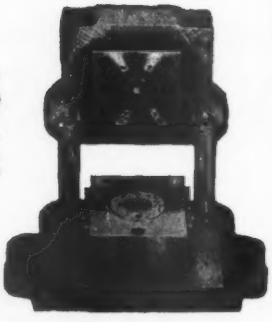
There's no need to make a complete new Die for any type washer or blank. The HOVIS UNIVERSAL WASHER DIES provide a Master Holder and by merely changing 5 SMALL, EASILY REMOVABLE PARTS the new washer or blank is produced . . . Special sets of parts are available for use in Master Washer Units enabling customers to produce irregularly shaped pieces and shallow draws. Multi-Washer Dies are also designed and manufactured.



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Drills, Reamers, countersinks, counterbores, carbide tools, tool bits and special tools are covered in the latest general catalog issued by Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich. A technical data section contains helpful information on cutting tools.
Circle Inform-A-Gram No. B23.

Steel Extrusion Tools are the subject of a catalog recently prepared by Industrial City Boring Co., 11474 E. Nine Mile Rd., Van Dyke, Mich. The illustrated circular displays the facilities, capabilities and past experience of Industrial City Boring in designing and building extrusion tools.
Circle Inform-A-Gram No. B24.

Sine-Line and Lead Axial Pitch Checker. In this brochure, the use of the machine with a recorder, gear capacities and use of either manual or power drive are discussed. Literature available from Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Circle Inform-A-Gram No. B25.

Setup Methods as well as typical work performed by Wales drilling machines, are described and illustrated in a new journal by Wales-Strippit Corp., 345 Payne Ave., N. Tonawanda, N. Y. Featured in the literature are data on the standard and deluxe models of the Wales machines.
Circle Inform-A-Gram No. B26.

Why Do S-P Non-Rotating Air Cylinders have a long-service-free life? The answer to this question and other data on the design, dimensions and specification of the air cylinder can be found in a new catalog available from S-P Mfg. Corp., 12415 Euclid Ave., Cleveland 6, Ohio.
Circle Inform-A-Gram No. B27.

Vertical-Vibratory Parts Feeders, developed to provide single line feeding of small parts to automatic machines without the labor cost involved in human feeding, are fully described in a new pictorial offered by Syntron Co., Box 220, Homer City, Pa. Application, operation, design features and installation data included in the brochure.
Circle Inform-A-Gram No. B28.

Angle and Drill Press Vises are among the many Palmgren products for machine tool work described in a recent folder put out by the Chicago Tool and Engineering Co., 8383 S. Chicago Ave., Chicago, Ill. Included in the illustrated brochure are specifications on more than 20 products from vises to milling attachments for engine lathes.
Circle Inform-A-Gram No. B29.

Clamp Support Blocks from Podlin Tool Co., 3918 Wesley Terrace, Schiller Park, Ill., give stable adjustment from ½" to 10", are instantly adjustable, only two parts. **Circle Inform-A-Gram No. B30.**

Cutting, Bending and Punching in round or flat metals can all be done on the Multi-Form machine, available in air or hand operated models, several different sizes. Largest work capacity ½" x 4". J. A. Richards Co., Kalamazoo, Michigan. **Circle Inform-A-Gram No. B31.**

R. B. Tools in Tungsten Cobalt HSS are combined in set #106B-K. Each set consists of holder and twenty tools. Data sheet from R. B. Tool Co., Hartsdale, N. Y. contains details of these and other combination sets for boring, threading, facing and recessing. **Circle Inform-A-Gram No. B32.**

116 Pages of End Mill Information. Over 1000 sizes and types of end mills with many new additions including the new "Positiv-Lok" series, are featured in the latest catalog from Putnam Tool Co., 298 Charlevoix Ave., Detroit 7. **Circle Inform-A-Gram No. B33.**

P.D.Q. Tool Holder permits faster tool changes and assures accurate repositioning. 3 point holding eliminates run-out. Adaptors for turret lathe, end mill, shell mill, drill chucks and boring heads. Portage Double-Quick Tool Co., 1046 Sweitzer Ave., Akron, Ohio. **Circle Inform-A-Gram No. B34.**

A New Air Cylinder bulletin has just been published by Carter Controls, Inc., 2920 Bernice Rd., Lansing, Ill. Besides describing the new features of the air cylinders, dimensions are given for six standard mounting styles, plus a complete cross section diagram, a parts list and dimensional chart for rod eye and rod clevis. **Circle Inform-A-Gram No. B35.**

Materials Handling Equipment and "C" clamps are covered in a 36-page catalog just released by Allied Mfg. & Sales Co., 201 N. Wells St., Chicago 6, Ill. The booklet is letter file size and conveniently arranged with color coded tab separators for each equipment classification. **Circle Inform-A-Gram No. B36.**

Jaspar Milling Machines, types 3MCB, 2CR, 3CS and 3MVS are featured in an illustrated brochure offered by Morey Machinery Co., Inc., 410 Broome St. New York 13, N. Y. Specifications are included in the data concerning the universal machines from one of Belgium's leading manufacturers. **Circle Inform-A-Gram No. B37.**

Precision Lathes and Micro Drill Presses for small accurate production work are described in detail in a new catalog published by Louis Levin & Son, Inc., 782 E. Pico Blvd., Los Angeles, Calif. **Circle Inform-A-Gram No. B38.**

Forced Internal Lubrication is the latest and most complete way of lubricating lathe and grinding centers. Advantages of this new method is the subject of a bulletin released by Tool Service, P. O. Box 10265-D, Tampa, Fla. **Circle Inform-A-Gram No. B39.**

A New Product of the Acme Broach Corp. is its Vertical Single Slide Surface Broaching Machine. Details, including specifications, available by writing Acme Broach Corp., Milan, Mich. **Circle Inform-A-Gram No. B40.**

Descaling Hot-Rolled Steel Sheets by airless blasting and eliminating acid disposal problems are the topics discussed in a new bulletin published by American Wheelabrator & Equipment Corp., 1183 S. Byrkitt St., Mishawaka, Ind. **Circle Inform-A-Gram No. B41.**

Tank Maneuver on the Production Front

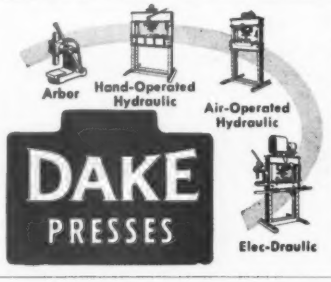
A military contractor in Minnesota paid an outside firm $6 per wheel just to remove worn tires from tank track wheels. An alert management saw in the Dake 150-ton hydraulic platen press an opportunity for a smart, moneysaving operation.

When the press had been installed, it brought these interesting results:

- **Two operations were combined into one—pressing the old tire off the wheel, and pressing the new one on in a single move.**
- **The removal-replacement job now costs only 15 minutes of an employee's time—compared to $6 per wheel for removal only as it was handled before.**
- **It saves the time lost in sending work out — avoids delays in the supplier's shop—helps get jobs delivered on time.**

How about your production? It may very well be that a Dake Press will speed up work for you, too. Dake has a wide variety of hydraulic presses in its standard line . . . also stands ready to custom-engineer presses for jobs that standard models can't handle. It will pay you to consult your nearest Dake distributor.

Dake Engine Company, 634 Seventh St., Grand Haven, Mich.



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Please send me a copy of Dake Catalog No. 129

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Hardness Testing on all Types of Work is made possible with the "Scleroscope" by Shore Instrument Mfg. Co., Inc., 9025 Van Wyck Ave., Jamaica 2, New York. Literature covers all models fully.
Circle Inform-A-Gram No. B42.

Current D-S Grinder Catalog is offered by Royal Oak Tool & Machine Co., D-S Grinder Div., 613 E. Fourth Ave., Royal Oak, Michigan. Hand and power operated models give radically improved tap, drill, and counterbore grinds.
Circle Inform-A-Gram No. B43.

Lever, Screw, and Air Feed Models of the Nichols miller are featured in latest catalog from Nichols-Morris Corp., 50 X Church St., New York 7, N. Y. Also three types double spindle machines.
Circle Inform-A-Gram No. B44.

Angle & Radius Dressers by Sperman Metal Specialties, 1085 Rogers Ave., Brooklyn 26, New York are described in a circular now available. Compact design allows dressing from underneath wheel. Full data now ready.
Circle Inform-A-Gram No. B45.

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Complete bulletins and operating data are quickly available. Send today, stating your particular production problem. Use the Coupon.

Whether you're finishing a casting, a weld, a fine die or stainless steel surface, you'll get the equipment that will do the job best from the best-known name in flexible shaft equipment—Haskins. Here is a company with a world of finishing experience to offer you—and a line of flexible shaft equipment in which long-life, multiple usefulness and economy have never been sacrificed to price.

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Firm Name _____

Street address _____ City _____ State _____

The "GF" Work Driver can be used instead of driving dogs for clamping or driving rough or smooth blanks between centers. Only a slight rotation of the hood grips is needed to disengage the work piece easily and quickly. Complete information and specifications available from U. S. distributor of this product, The Skinner Chuck Co., New Britain, Conn.
Circle Inform-A-Gram No. B46.

Graphitic Tool Steel excells for die use, has outstanding anti-friction qualities with minimum tendency to scuff, seize, score or gall. Graphitic steel book from Timken Roller Bearing Co., Steel & Tube Div., Canton 6, Ohio, has all data.
Circle Inform-A-Gram No. B47.

P-K Quality Controlled Self-Tapping Screws are featured in latest bulletin. Each type screw is detailed as to size and styles, with typical applications. Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.
Circle Inform-A-Gram No. B48.

Vernier Height Gages, Calipers, Depth Gages, thread, ring, and snap gages represent just a few selections from the enormous stock of the Sid Tool Co., Inc., 126 Lafayette St., New York 13, N. Y. Mailing list now open for new names.
Circle Inform-A-Gram No. B49.

Sharp Image Definition with glare-free accuracy is feature of "Century" optical comparator. Illustrated circular describes features and operation. From Portman Instrument Co., 6 Manhasset Ave., Port Washington, N. Y.
Circle Inform-A-Gram No. B50.

Low Cost Precision is available in the "Tuna" vernier caliper from Swedish Gage Co. of America, 8900 Alpine Ave., Detroit 4, Michigan. Best Swedish steel, hardened measuring surfaces. Full specifications from maker.
Circle Inform-A-Gram No. B51.

Reltool End Mills and Holders are priced and given full description in latest discount sheet and catalog No. 50 from Reltool Corp., 412 W. Michigan St., Milwaukee 3, Wis. Over 1000 stock sizes, many different styles.
Circle Inform-A-Gram No. B52.

Hand Feed Replaced Easily with the Acro-Bore boring unit, adaptable to boring heads, having a steady feed in any belt position. Gives fast accurate work with maintained tolerances and longer tool life. Skyline Tool & Gage Co., 4127 Newark Ave., Cleveland 9, Ohio.
Circle Inform-A-Gram No. B53.

Tapered Milling Cutter Information such as sizes, design and specifications is yours for the asking by writing Detroit Mold Engineering Co., 6686 E. McNichols Rd., Detroit 12, Mich.
Circle Inform-A-Gram No. B54.

Precise Grinder Miller Attachment is described in catalog now available from Precise Products Corp., 1341 Clark St., Racine, Wisconsin. ¼HP, 20,000 to 45,000 rpm. Ideal for carbide cutters.
Circle Inform-A-Gram No. B55.

How Steel Is Made and then forged into products such as die blocks, shear knives, back-up roll sleeves and automatic tongs is briefly explained in a new booklet issued by the Heppenstall Co., 4620 Hatfield St., Pittsburgh 1, Pa.
Circle Inform-A-Gram No. B56.

Marking Part Numbers, patent numbers, trademarks, etc., is made easy with the new Model 600-E Automatic Roll Marker. Dimensions, complete setup and operating instructions and specifications of machine are available in folder offered by New Method Steel Stamps, Inc., 147 Joseph Campau, Detroit 7, Mich.
Circle Inform-A-Gram No. B57.

Precise Circular Spacing and angular positioning jobs become fast and easy with assured high accuracy when done by precision rotary tables made by Pratt & Whitney, West Hartford 1, Conn. Learn more about this P & W machine by writing for illustrated circular.
Circle Inform-A-Gram No. B58.

Just Off the Presses is the Newman Industries' 2-color catalog containing specifications, illustrations and dimensions of its totally enclosed, fan-cooled, squirrel cage motors up to 30 hp and drip proof models up to 125 hp. Write Newman Industries (America) Inc., 43 Broad St., New York 4, N. Y.
Circle Inform-A-Gram No. B59.

Precision Surface Grinders for tool room and production grinding operations are thoroughly described and illustrated in a 20-page catalog offered by the DoAll Co., Des Plaines, Ill. A number of grinding accessories also are shown in the highly informative brochure.
Circle Inform-A-Gram No. B60.

Protects Metal Parts from rust and corrosion up to 10 years is the claim made about the new VCI-lined cushioned bags for shipping and storing parts. A 4-page folder put out by Jet-Pak, Inc., 859-879 Summer Ave., Newark, N. J., gives all the details on this product.
Circle Inform-A-Gram No. B61.

Low Maintenance and High Production are boasted by Rousselle punch press line of the Service Machine Co., 7627-33 S. Ashland Ave., Chicago 20, Ill. OBI, horn, and deep throat types.
Circle Inform-A-Gram No. B62.

A Pocket-Size Reamer Selector can be had by writing Lavallee & Ide Inc., Chicopee, Mass. This reamer chart lists 143 hole sizes from 0.4000 through 0.5010" which can be reamed with standard Lavallee & Ide reamers.
Circle Inform-A-Gram No. B63.

The Nobur Tool eliminated hand deburring, substitutes speedy machine operation. A pamphlet from Nobur Mfg. Co., 717 N. Victory Blvd., Burbank, Calif., has all data.
Circle Inform-A-Gram No. B64.

Table of Draft Angles charts are being sent to those requesting them by Detroit Mold Engineering Co., 6686 E. McNichols Rd., Detroit 12, Mich. Actual decimal amount of draft or relief is given for any depth of all angles from ½ to 30 degrees.
Circle Inform-A-Gram No. B65.

There is a Johnson Dealer Near You

This JOHNSON Model B

offers all the Features of a BIG MACHINE in this handy Small Saw. Cuts 5" rounds, 10" flats

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ALBION, MICHIGAN

Flat Lapping and Roller Lapping Machines are featured in bulletins now available from Spitfire Tool Co., 2395 N. Pulaski Rd., Chicago 41, Illinois. Finishes to extremely close tolerances are produced.
Circle Inform-A-Gram No. B66.

Hardened and Ground H.S.S. Blanks in any decimal diameter to ½" and in any length are covered in current literature from William T. Hutchinson Co., 235 Main St., Orange, N. J. Mirror finish close tolerance surface.
Circle Inform-A-Gram No. B67.

Keyway Broaches are thoroughly described in the latest bulletin from the duMont Corp., Greenfield, Mass. Also included is data on duMont high speed ground tool bits. Information on both tools and broaches consist of complete specifications.
Circle Inform-A-Gram No. B68.

276,000,000 Standard Punch Sizes and Types are now available at standard prices from Pivot Punch & Die Corp., 373 Old Niagara Falls Blvd., North Tonawanda, New York. Catalog 514 tells story.
Circle Inform-A-Gram No. B69.

ARMSTRONG

SET-UP *and* HOLD-DOWN TOOLS

PLANER JACKS

ARMSTRONG Set-up and Hold-down Tools reduce setting-up time—keep men and machines producing. Designed for use on planers, drill presses, milling machines, etc., they hold work securely and rigidly, and thereby reduce spoilage and prevent costly accidents.

Your local Armstrong Distributor carries ARMSTRONG Set-up and Hold-down Tools in stock in sizes for every operation. Stop haphazard setting-up methods. Provide each of your machines with a full complement of ARMSTRONG Set-up and Hold-down Tools.

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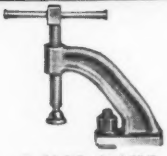

T-SLOT CLAMP

NON-SKID JACKS

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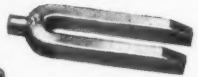

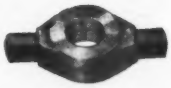

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A Newly Published Catalog and parts manual covering 37 models of Dyna-Kilns and Dyna-Kiln Electric Furnaces is offered by the L & L Mfg. Company, Chester 81, Pa. The line of furnaces is described in detail and also given arc kiln and furnace sizes, shipping weights etc.
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Data Sheet on Desegatized HV-6 HSS now available from Latrobe Steel Co., Latrobe, Pa. Analysis figures, forging, tempering, hardening and annealing data all given.
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Six Points to Better Press Construction is the theme of a new brochure offered by Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill. Among the features discussed are press frames, tie rods, slides, clutches, clutch controls and connections.
Circle Inform-A-Gram No. B81.

Sciaky's Rotating Upper Stitch Welding Head which fits any electric resistance welder is discussed in a new brochure offered by Sciaky Bros., Inc., 4915 W. 67th St., Chicago, Ill. The bulletin explains how gas tight seams of overlapping spot welds are produced to government and aircraft specifications.
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An Illustrated Bulletin describing features of the recently announced Sheer Speed Soluble Oil used for metal cutting, grinding and forming operations, is available from Sheer-Speed Chemical Products, 7125 E. McNichols Rd., Detroit 12, Mich.
Circle Inform-A-Gram No. B83.

South Bend Lathe recently issued a handy 12-page catalog (No. 5304) covering its line of 9" lathes, floor and bench models. Photos included plus graphic line drawings of features on each type and model. Write South Bend Lathe, 425 E. Madison St., South Bend 22, Ind.
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The Great Lakes Broach & Gage Co., 1008 Franklin St., Detroit 7, Mich., pioneers in jet propulsion and gas turbine broaching development, presents a new flat broach sharpener in literature now available. Radius and plug gages are also discussed.
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Adjustable Rod Guard for Punch Presses is one of the complete line of guards shown in the current catalog from Humm Safety Equipment Co., 253 Sheffield Ave., Brooklyn 7, New York.
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Tracing Templates and a catalog for Lodding clamps and details are now available from Lodding Inc., 73 Beacon St., Worcester, Mass.
Circle Inform-A-Gram No. B88.

A Three-Phase Projection Welder, the Sciaky EPT 2 Machine, is now available in 50 KVA, 75 KVA and 100 KVA at 50% duty cycle. Details covering this air operated, press-type electric resistance projection welder furnished upon request by Sciaky Bros., Inc., 4915 W. 67th St., Chicago, Ill.
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Commander Production Tools are subject of attractive brochure from Commander Mfg. Co., 4225 W. Kinzie St., Chicago 24, Ill. Tappers, multiple drill units, chip breakers and coolant tables featured.
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. . . **Low Temperature, from page 77** was introduced, six years were required to age Class AA gage blocks (0.000002" accuracy). Shipment could not be made until one year later, and Bureau of Standards certification was not given for still another year.

Considerable controversy centers around the sequence of heat-treat operations, and the position of the chilling steps in the production cycle. One procedure developed for the Class AA gage blocks mentioned called for preheating the material to 600°F, then heating to 1575°F. Blocks were held at heat for four minutes to ensure uniform temperature. Blocks were then oil quenched at 85°F, being slid slowly into the bath, entering end first, minimizing thermal shock and setting up uniform stresses. This method prevents cracking and helps to ensure required high hardness. Oil is used in order to minimize corrosion.

Material is then tempered at 275°F for one hour to relieve stresses developed by quenching. It is then cooled to -120°F. This tempercooling cycle is repeated five more times. The first cycle effects the greater part of the transformation to a martensite structure. After the fifth cycle, transformation is virtually completed. At this point, further cycling causes a slight drop in hardness. Cycling is continuous in order to maintain an unbroken temperature curve.

Tool steels are not the only metals vastly improved by heat treating at low temperatures. In the past, several years were required for aging steels for precision instruments to permit the metal used to become stabilized. This process that took so long for nature to complete is now taken care of in a couple of hours by the use of -150°F refrigeration. The general procedure for accelerating the aging is to cool the metal to -150°F, warm gradually to +200°F, and soak for 10 hours in an oil bath, cool to -150°F for another 10 hours, and warm to room temperature. The metal is then ready for machining, to be made into precision instruments requiring close and unchanging tolerances. The low temperature cooling of steels is done either by placing them in air in refrigerated cabinets or by immersing them in non-freezing liquid.

Effects of Low Temperatures Upon Metal

Before proceeding to discuss other uses for sub-zero treatment of metals, it would be well to go back and see what happens internally.

On the basis of investigations conducted so far, it appears safe to predict that more completely transformed structures may be obtained by subjecting the work to low temperatures for given periods of time following somewhat conventional heating and cooling methods. It has been found that physical characteristics of most steels may be definitely improved through further decomposition of austenitic structure at low temperature.

Everyone is familiar with the fact that properly alloyed steels harden when quenched to room temperature following heating above the critical range. But what happens when further quenching to temperatures lower than room temperature? This question has inspired investigations carried out by many scientists.

When steels were subjected to extremely low temperatures, a change in micro-structure was noted. This was revealed to be a greater percentage of fine martensitic needles. Then, higher magnetic values were noted and measurements also indicated an increase in volume. However, it was found that cooling has to be done immediately to obtain its **full** advantage. Transformation of the as-quenched structure, austenite, to the harder constituent, martensite, in most cases was nearly complete **only** when refrigeration

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says JOHN J. FUSCO, Consulting Engineer
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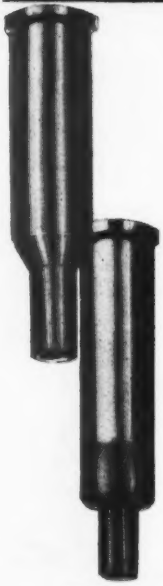

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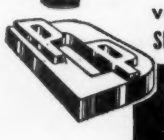

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immediately followed the conventional quench. Samples allowed to stand at room temperature for periods of time before refrigeration developed a resistance to transformation and required lower temperatures to overcome this condition.

Temperatures tried experimentally indicate that -150°F provided the ultimate in transformation, but that the major part of the change occurred between -120°F and -150°F. As for the hardening furnace temperatures, it was found that the lower end of the range such as 1850°F did not give positive results. Results became more positive as the hardening temperatures were progressively increased, with a range of 2300°F to 2350°F providing the best results. The figures given refer to high speed steels. Other materials impose their own requirements.

In general, cold treatment is still subject to much discussion. There is now becoming available more accurate data regarding the advantages and limitations of low temperature treatment, so that the prospective user can determine whether or not the process will benefit him.

Basic Principles of Heat Treating

Much of the data available on low temperature work is confined to tool steels of high carbon content. It has been less difficult to obtain accurate test data on these than on some other steels, particularly the carburizing grades. The basic principles of heat treating steels can be most easily explained by limiting it first to the common straight carbon types of steel.

Straight Carbon Steels. When the steel of this composition is heated to a temperature of about 1450°F, the carbide dissolves in the matrix, forming austenite. Of course, if all carbides were to be dissolved, an extremely long period of time would be required. In fact, complete carbide solution would probably be impossible if there were no increase in temperature. A higher temperature, referred to as "austenitizing" temperature (at which austenite is formed), causes the carbide solution to proceed rapidly becoming virtually complete at 1750°F or 1800°F in a very short time. In practice, however, it is not usually desirable to obtain 100% carbide solution or even anywhere near such a percentage. It is more common practice to dissolve only about 60 to 70% of the carbide. Since this can be accomplished in a relatively short period of time at 1450°F, this temperature has become the most common for any steel corresponding to 1% carbon tool steel.

The structure at the austenitizing temperature is composed of austenite and undissolved carbides. When the steel is cooled from this temperature, the undissolved carbides remain unaltered; but, the austenite undergoes a major change since it is generally unstable at temperature lower than about 1350°F. Any structure formed under 1350°F will be in the alpha phase, but whether this new structure is pearlite, bainite, or martensite, or a mixture of these structures, is dependent entirely upon the manner and the rate in which the cooling takes place.

In order to harden this type of steel, it is necessary to employ an extremely rapid quench so as to cool through the 1000° range almost instantly. If this cooling is accomplished with sufficient rapidity, the formation of pearlites will be entirely suppressed and the austenites will begin to decompose at lower temperatures, forming other types of structures. It is usually desirable to form a structure composed principally of martensite, which is the hardest of all structures.

The temperature at which martensite begins to form in the type of steel being considered, when austenitized at 1450°F, is approximately 475°F. The change from austenite to martensite at this temperature is not abrupt but merely represents

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the temperature at which the undercooled austenite begins to slowly transform. As cooling proceeds down to room temperature, the formation of martensite takes place with increasing rapidity. The rate of cooling from the martensite temperature to room temperature is not extremely critical, since martensite is the only structure that will form from austenite at this relatively low temperature.

There is some transformation of austenite effected even at temperatures as low as -250°F or even lower, in some of the very high alloy steel. When steel of the 1% carbon tool steel type is rapidly quenched to room temperature, about 91% transformation takes place. As the cooling proceeds on down to -150°F, a total of 97% transformation is shown. Since cooling to -150°F shows 3% austenite remaining, it is questionable whether or not a temperature sufficiently low to effect a 100% transformation could be reached. It is obvious from this, though, that the lower in temperature you are able to subject the steel during the quenching, the greater will be the transforming effect.

High Speed Steel. In the heat treatment of higher alloy steel, such as well known 18-4-1 high speed steel, an entirely different set of conditions is encountered. In the first place, the carbides in a steel such as 18-4-1 are principally of the complex type instead of the common Fe_3C as is found entirely in Type A steel. The complex carbide is extremely reluctant to dissolve in the austenite, so that it is necessary to employ very high austenitizing temperatures in order to effect an appreciable degree of carbide solution. This type of steel becomes austenitic at approximately 1500°F, but at this temperature practically no carbide will go into solid solution. Probably the most commonly used austenitizing temperature for this type of steel is 2325°F.

Stainless Steel. Stainless steel of the 18-8 type cannot be hardened through conventional heat treatment, since its carbon and alloy content causes it to soften when quenched from temperatures of 1800° to 2000°F. When increased hardness is essential, a shallow surface hardness may be obtained with special nitriding method. Most satisfactory surface hardness, however, may be had by introducing refrigeration. First, the pieces are carburized preferably by the liquid method, but air carburizing may be used. This is followed by quenching in oil or brine and then refrigerating at -150°F. Hardness values to 60 Rockwell "C" have been obtained by this method, although the metal's corrosion resistance is considerably lowered. Careful consideration of this fact and experimentation will be necessary in order to fully evaluate the application of cold treatment of 18-8 stainless.

High-Carbon High-Chromium Steel SAE-52100 can develop a condition of retained austenite upon quenching. Other alloy steels evolve similar problems difficult of solution. One manufacturer of pumps had found that plungers grew in service through the decomposition of austenite into martensite which required more room. These plungers were heat treated by conventional methods and ground to very close tolerances, but an examination proved that breakdown of the austenite was incomplete in the tempering operation and was taking place as the part aged. In answer to the problem, the decomposition was accelerated to the point of completion by tempering, refrigerating, retempering, refrigerating, and retempering. No further difficulties were reported in the field.

Structural Steels. Some investigation has been made on the effect of low temperatures on some of the medium carbon structural types of steel, including straight carbon as well as the low alloy type. Thus far, the results have been negligible,

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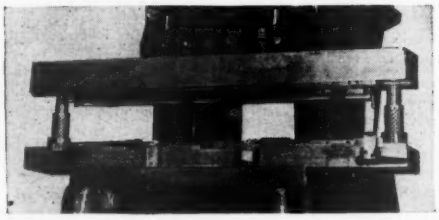

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which was to be expected. However, there is need for this field to be explored more thoroughly.

Alloy Carburizing Steels. All types of steel referred to previously have been of the through-hardening type. In all cases, the type of quench and the size of specimens were such that they were hardened clear through. Using this method, it becomes an easy matter to accurately measure the austenite volumetrically. In the case of carburized or alloy carburizing steels, such as SAE 2512 and SAE 3316, it is necessary to use a different method of attack in order to obtain accurate test results. Here the carbon content varies over quite a wide range from the surface to the core, presenting an entirely different set of conditions.

Measurements such as used with through-hardened steels would merely show the amount of existing austenite in the whole test piece, and would give no accurate determination as to its distribution. It would, of course, be logical to assume that most of the retained austenite would be within the superhardened, outer case zone.

For this class of steels, it is necessary to resort to hardness tests, x-ray diffraction, and microscopic studies in order to determine the amount of transformation. This handicap should not forestall work with this group, since these alloy carburizing steels have been found to be benefited to a greater extent by cold treatment than any of the high carbon and higher alloy steels.

Low Temperature Process Techniques

To hold parts at the low temperature in order to gain all possible benefits, the minimum time can be assumed to be one hour per inch of thickness at the maximum section. A longer time at the low temperature is not in any way harmful. If a medium of liquid is used in the low temperature chamber instead of air, the holding time is naturally lessened.

The period of time the work is allowed to remain at room temperature between its quenching and its subjection to low temperatures, is not critical. This, however, must be qualified. With a lapse of time, austenite does tend to become stable at room temperatures through some "aging" phenomenon, and thereby becomes increasingly difficult to decompose.

Holding the work at room temperature for as short a time as one hour has a detrimental effect, and 10 hours reduces the efficiency of the sub-zero treatment by 50%. Therefore, it is always advisable to carry out the low temperature treatment as soon as possible after the quench, with work being held at or near room temperature for no appreciable length of time. It is probable that the higher the carbon content, the more important this becomes. Furthermore, arresting the quench above approximately 225°F is not recommended, since a majority of the austenite would then not be transformed until the steel is cooled from the tempering temperature with even greater cracking hazard.

Another question is whether or not the practice of tempering after the quench and prior to using the low temperature will seriously impair transformation at low temperature. It may be noted that, for projects fully described above, specimens were cold treated after the quench and prior to any tempering operation. It has been found that any tempering prior to cold treatment usually tends to lessen the ultimate effect.

In the case of the steels which are tempered only in a relatively low temperature range (300° to 350°F), the effect on a subsequent low temperature treatment is so slight that, for practical purposes, it usually does not matter in which sequence the operations are performed. For the alloys which are tempered in the higher ranges from 900° to

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1100°F, the effect on transformation from a subsequent cold treatment is far greater. A cold treatment applied to steels after having been tempered in the range just mentioned is usually less than one-half as effective compared to results obtained from employing the low temperature treatment immediately after the quenching.

Another question is whether more than one cycle of cold treatment is of any benefit. This is still somewhat of a question on low alloy steels. Tests made by some metallurgists show absolutely no effects from a second or third cycle at low temperature while, in other cases, some small percentages of transformation have been obtained. Due to the amounts having been so small, they have been regarded as being within the limits of experimental error. In the case of high alloy steels, multiple cold treatment definitely is beneficial.

Another question frequently asked is in regard to the possibility of cracking a part, particularly when they are subjected to the extremely low temperatures without any tempering. There is danger, in certain cases, with highly hardened parts suddenly subjected to the low temperature. Metallurgists have determined that cracking will not occur from thermal shock, but rather from the stresses set up by the volumetric changes which take place during the transformation to martensite as effected by the low temperature. In other words, the conditions encountered are comparable to tempering the high alloys too rapidly.

Under some conditions, cracking does occur but — through increasing familiarity with the new processes — such cracking can be held to a minimum. Of course, it is desirable to avoid sharp corners and even sharp edges since these can be ground after treatment. Rockwell hardness testing after refrigeration and before tempering also should be avoided since cracking sometimes occurs at the point of indentation. It has been the experience of many that the higher alloy steels will frequently be found cracked after tempering, although it was sound after the quench. This is particularly true if the steel has been austenitized at abnormal temperatures, thus allowing a high percentage of transformation to take place during tempering. Steels containing considerable proportions of austenite are provided with a "cushion" of high plasticity for accommodation of considerable stress. If this cushion is removed, particularly at very low temperatures where plasticity in general is quite low, stresses resulting from natural dimensional changes occur and present a serious cracking hazard.

Some metallurgists have experienced little cracking in any types when the cooling was done in a medium of air. It is logical that the rapid transformation encountered in immersing the work in liquid held at extremely low temperatures would be more likely to result in cracking. There has never been encountered any cracking in applying cold treatments to the low alloy or carburizing steels. It becomes a matter of judgment and of using precaution when cold treating the high alloys, which should be practiced in the whole treating cycle anyway, if optimum results are to be obtained. It is definitely recommended that if the high alloys must be cold treated in liquid, some arrangement should be made for the cooling to be done in two or more steps.

Effect Upon Hardness

An interesting and still controversial application for cold treatment is the hardening of metals. There have been numerous articles written both pro and con on this subject. Maximum hardness is sought as an answer, in turn, to a wide number of manufacturing and service problems. Unfortunately, hardness in itself is not necessarily a true indication of other properties,

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such as wear resistance or corrosion resistance. Nevertheless, hardness is a widely used measuring stick, and the main reason given for seeking as nearly as possible a 100% transformation is very often to obtain higher hardness value.

It is obvious that low temperature treatment is only capable of transforming a certain percent of retained austenite in hardened steels. The change in hardness will, to a degree, reflect the extent of transformation but will be influenced by numerous other factors. Therefore, hardness readings must be considered, at the very best, relatively rough measurements of actual results.

One can predict the amount of increase in hardness value by the relationship of the curves which show the percent of austenite at various austenitizing temperatures either before or after cold treatment. The reason for the increased effect of low temperature on specimens austenitized at abnormal temperatures is attributed to the fact that the higher austenitizing temperatures drastically lowers the temperature at which transformation begins and, subsequently, the entire martensite formation range.

It has often been stated that cold treatment would serve to aid in the correction of any tool or other part that had been maltreated in the cycle of heat treatment. This is a broad statement and is true only to a limited extent. The effect of cold treatment is lessened on any steels which have been austenitized at sub-normal temperatures or, for some reason, show an abnormally fine grain and too much undissolved carbide. Therefore, since the function of cold treatment is definitely confined to the transformation of austenite, one should be careful in stating that maltreatment had been corrected just because an extraordinary increase in hardness had been effected.

Since it is not possible to increase the hardness of steel or improve uniformity whenever and wherever needed merely by the use of refrigeration, it is well to approach first those applications which are practical.

When steel is in one of the following two conditions, cold treatment can be effective:

1. When the metal is a super-saturated solid solution. Iron at room temperature (ferrite) has an absorptive capacity for carbon, far below that of iron at elevated temperatures (austenite). Hence, the metal may have dissolved in it at 1500°F much more carbon than it can dissolve when cold. A sudden quench may prevent the separation of the carbon "excess" and result in a metal which at room temperature is in a super-saturated condition.

2. When the steel is super-cooled. If the steel is quenched from a temperature at which it is austenite, the presence of considerable dissolved carbon or alloying elements or both may so interfere with the change from austenite to ferrite plus pearlite during the cooling that the austenite structure is retained at room temperature. This constitutes a super-cooled condition.

Benefits from cold treatment are practically a certainty when the character of the steel is as follows:

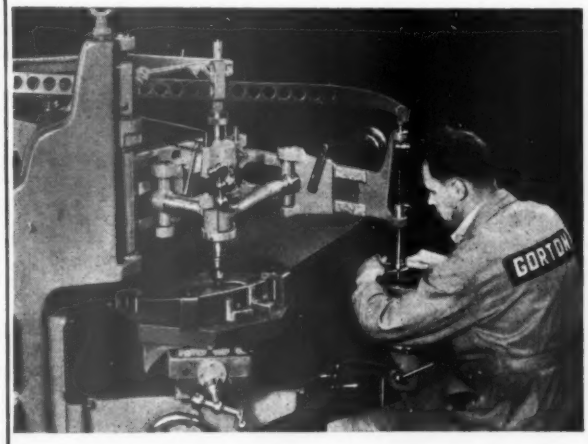
1. Medium to high carbon steel, or alloy steel, or with both medium to high carbon and alloy content.

2. In the "as quenched" condition, or "quenched with low temperature draw" condition.

3. "File hard" or nearly so, yet with a Rockwell "C" hardness under 55.

Hardening of High Speed Steels

Many different cycles have been tried in treating high speed steel. It has been found that subjecting the work to extremely low temperatures from the oil quench, with or without an intermediate air cool, appear to give the best results. From the low temperature, the work is raised to the first temper (1050°F)



Tracer-Controlled Pantograph cuts and rounds thermal slot in 8-foot steel propeller blade in 40 minutes; previous time was 5 hours, 10 minutes — just one of hundreds of examples of time and cost saving with tracer-controlled Pantograph machines.

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By George Gorton III
Executive Vice President
George Gorton Machine Co.

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for 2½ hours, air cooled, raised to a second temper for one hour, then air cooled again.

Even when the cooling is more or less continuous from the quench to the extreme low temperatures, double tempering is recommended. The first cool leaves approximately 9 percent of the austenite untransformed, and no amount of time or a lower temperature will appreciably alter this condition. It is, therefore, necessary to "condition" the remaining austenite by the first temper, so that it will transform on cooling to room temperature. It is desirable to stress-relieve this last formed martensite for best properties, hence, the second temper.

The first temper, if less than 2½ hours at 1050°F, will not permit sufficient precipitation of carbides at the tempering temperature to allow for complete transformation of the retained austenite on cooling, while more than three hours causes some loss in both room temperature and hot hardness, strength and toughness.

Certain workpieces, particularly large ones of complicated section or with sharp corners or edges, will be found to tend toward cracking when processed in the above manner. In such instances, the work may be air cooled only after quenching, raised to the first temper for 2½ hours and then brought to the sub-zero temperature. The work may then be given a second temper of one hour and air cooled, or given a second temper of 2½ hours, air cooled, a third temper of one hour, and air cooled again. Either of these two cyclings provide a means of treating parts that would be certain to distort or crack if sub-zero cooled directly, although final properties will not be quite as good.

Some degree of improvement is usually noted when work finished in conventional manner is subjected to sub-zero temperatures. The improvement, while sufficient for some applications, is not equal to that obtained when the sub-zero cooling is included within the heat-treat cycle as described above. If treatment of "fully tempered" tools proves to be reliable and useful its basis must lie in either the transformation of small amounts of retained austenite to martensite or in some new phenomenon which may unsuspectedly be occurring during the cold treatment, such as a precipitation of carbide particles in a finely dispersed state or an alteration in the pattern of internal stresses.

Typical hardness readings show that specimens subjected to temperatures of -110°F range between 65.7 and 66.3 Rockwell "C", before tempering. This is considerably higher than the hardness before tempering, of specimens quenched and cooled to air temperature, without the benefit of cold treatment. Cold treated parts will not necessarily be superior in hardness after tempering to that before tempering. It appears that, with such work, the maximum secondary temperature is attained much more quickly at the low-point in the initial cooling. It is likely that this hardness will be better retained by limiting tempering levels to 900°F to 950°F, and will be superior to that resulting from tempering at 1050°F to 1100°F.

In any case, cold treated tools usually display hardness of ½ to 2 Rockwell "C" higher than the maximum developed by conventional heat treating. However, tempering at 1100°F or higher causes a severe drop in hardness and should not be practised.

With tempering at 1050° F, low temperature cooling may produce an added improvement in ductility. If the work is only air cooled after quench, and sub-zero cooled after the first temper, tempering at 1150°F will have little or no effect upon hardness and strength and will also result in a remarkable increase in ductility.

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Hardening of Other Tool Steels

The analysis of the steel also is a factor in the degree of benefit to be obtained by cold treatment. High-carbon high-cobalt types are improved more than the 18-4-1 or 6-6-4-1 types.

Tools of the high-carbon high-cobalt and the high-carbon high vanadium types when hardened in a carburizing atmosphere such as high carbon-monoxide or Crycolene are sometimes difficult to fully temper. Tempering may be facilitated by injecting a low temperature cooling **after** the first temper.

Tools of the same analyses are effectively prepared for cyanide nitriding if first subjected to low temperatures. Without this cold treatment, there is enough retained austenite to cause embrittlement of the carburized cutting edge.

The damage done by abusive grinding can sometimes be largely eliminated by cold treatment, with resultant increase in tool life for example.

Shock-resistant steels, of the high tungsten variety used for cold-forging dies and mold hobs, are usually carburized for the required case hardness. This hardness can be substantially increased by cold treatment after a first temper at 350°F. The combination of hardness, strength, and ductility thus achieved is usually superior to that obtained in any other manner. Somewhat better results have been obtained by refrigerating immediately after quenching, then tempering at about 300°F. This was found to be true with shock steels which initially quenched out with core hardness of 50 to 55 Rockwell "C" and a case hardness of only 58 to 60 Rockwell "C". Immediate cold treatment raised the case hardness considerably.

High-carbon high-chromium steels tend to retain austenite after cooling. This is especially true if the work is pack-hardened, with carbon being added. A low temperature treatment of these steels will usually be successful in improving the hardness and other properties, regardless of when this step is taken. In other words, the work may remain at room temperature for a substantial length of time before cold treatment. This, you will remember, was not possible with the high speed steels. Another difference in handling high-carbon high-chromium is that maximum transformation is usually achieved at −80°F to −100°F.

Nickel carburizing steels, such as SAE 2315 and SAE 2512, often exhibit good core hardness but low case hardness, perhaps 52 to 58 Rockwell "C". Treatment at −120°F of these parts will usually increase the case hardness, as much as 12 to 15 points, without affecting the core hardness in any way.

Here are typical results obtained with cold treated cutting tools and die components:

1. Longer tool life, on occasion surpassing that obtained with so-called super-hard materials.
2. Less tool breakage.
3. Higher cutting speeds.

Forecast

The availability of mechanical low temperature machines, in their present form, permit cold treatment to be applied productively in industrial processing.

Because of its advantages as a **supplement** to standard heat treating methods, the cold treatment of metals at −150°F will increase in industrial importance in the next few years. Its applications can be summarized as follows:

1. Size stabilization can be accomplished with loss of hardness if a sufficiently low sub-zero temperature is used (−150°F or lower).

2. When there is much retained austenite, transforming it to martensite will increase both the size and the hardness of the parts. Therefore, −150°F processes can

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also be used to salvage conventionally heat-treated tools, gauges, or parts that are undersize or low in hardness.

3. Low temperature control of aluminum age hardening while now used mostly for rivets can also be employed to control hardening when parts are fabricated from heat treatable aluminum alloy sheets.

4. All hardened steels are improved by the proper cold treatment to the extent that there will be less tendency to develop any grinding cracks. They can be ground much more easily after the elimination of the retained austenite and the untempered martensite.

The change of the austenite structure into martensite must be completed before the product is machined to its final dimensions. Pieces of alloy steel have been known to grow as much as 0.0002", far beyond the tolerance allowed for many precision products, and exceeding many times over the tolerance limits for even commercial quality gage blocks. Cold treatment can accelerate this growth prior to finishing, thereby eliminating troublesome growth in service.

In many parts such as gears, it is not only desirable to have a high hardness as measured by the penetration method, but also to have them file hard and free from the highly austenetic surface or soft skin. High alloy carburizing steels, such as 25-12 and 33-16, used for such applications will have a greatly improved surface hardness as the result of refrigeration.

Green castings, ordinarily furnace annealed before machining, have been treated at —150°F, with no anneal. These cold-treated castings machined better and show no distortion as was experienced with annealed castings.

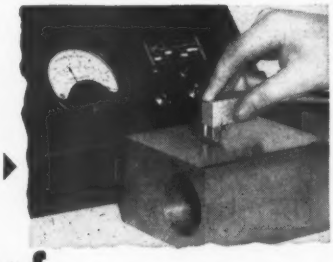
Cold treatment has been used successfully with aluminum castings and forgings to prevent dimensional changes and distortion.

The manufacture of hydraulic valves for aircraft was a difficult production problem prior to the adoption of cold treatment. The process was slow and costly. It was common to have valves tear while being drilled and tapped. Distortion was also excessive. After introduction of refrigeration, the cold treated valves could then be drilled and tapped without tearing, and the original dimensions were consistently held after machining. As a consequence, production has been greatly increased, quality improved, and production costs lowered.

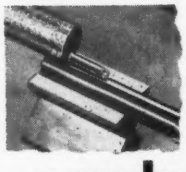
Another unique application of cold treatment is found in the rubber industry where flashings on molded rubber products are embrittled by low temperatures and then removed by tumbling. In the optical industry, cold treatment is used to embrittle the pitch bond used to hold lens to steel blocks for lapping, in order that the lens may be removed without damage.

Within the next few years, creative engineering and metallurgy is expected to greatly expand and add to these known industrial applications of cold treatment.

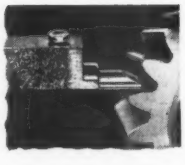
You can measure the roughness of nearly ALL machined and finished surfaces with the PROFILOMETER



Measuring roughness of a flat surface with manually-operated Profilometer Type MA Tracer. Meter shows average roughness height directly in microinches. Tracer also measures on ID's and OD's.



Measuring roughness of narrow spline with Type AW Tracer. Projecting nose of Tracer enters small holes.



Type J Tracer measuring roughness of gear tooth. This Tracer, like others, also measures on ID's, OD's, and flats.

Measuring roughness in 1/16" ID with Type KA Tracer.

Type GB Tracer measuring roughness of recessed groove.

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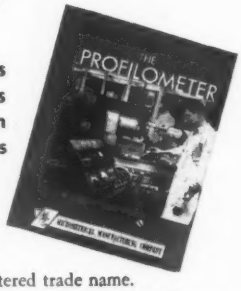

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Computing Air Gage Indicator

The original application of air gaging was for the checking of internal and external diameters. However, as its advantages became more apparent, air gaging was applied to multiple and complex measuring problems such as checking of tapered cylindrical parts, center distances, squareness between face and bore, concentricity, etc.

Whenever the air gage is used for one of these measuring problems, the gaging set-up is complicated by the fact that there is always more than one variable involved, since the readings are not only affected by variation of the above factors, but also by variations in diameter. Since the total effect of both variables must be considered in arriving at the final result, it is necessary to use at least two air circuits and a like number of indicators in order to arrive at the desired result. Furthermore, to resolve the problem fully, the operator frequently has to take readings from two air indicators, such as shown in sketch No. 1, then add or subtract the respective readings before the final answer can be obtained. This computation is required when checking tapered parts, center distances between holes, and clearances between mating parts.

When checking concentricity between diameters or squareness of bore to face, it is not usually necessary to obtain results from separate indicators and then compute an answer, but, due to the usual permissible variation in diameter involved, the position of the tolerance range on the scale will change, if the diameter varies from its mean value.

From the foregoing discussion, it can be seen that when applying the standard type of air gage circuit and indicator to these measuring problems, some of the value of air gaging has been lost, since more responsibility is placed on the operator and the human element has not been entirely eliminated.

Through the use of the computing indicator illustrated, it is possible to remove the effect of one of the variables (diameter) on the results shown by the indicator for value of angle of taper, concentricity, clearance, by applying the diameter variation to both sides of the differential measuring device, thereby nullifying its effect on the reading obtained on the dial. In this way it becomes possible to obtain readings for these dimensional characteristics on a single dial with a single pointer.

While it is still too early to judge the full effect of its impact on production gaging, it is clear that it will open the way for new thinking on gaging problems and far wider air gage utilization throughout industry.

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Airless Spraying Is Latest Attempt to Eliminate Waste and Health Hazards Associated with the Paint Industry

A considerable decrease in waste is anticipated with the advent of a new-type spray painting process employing hydraulic pressure combined with heat. This airless spray method also may lead to the elimination of elaborate spray booths, thus reducing maintenance problems besides doing away with some of the health hazards that have been associated with spray painting for the past 50 years.

The first user of this sprayer was a tractor builder in the Southwest who faced a law suit because during the process of painting his machines, he was damaging his neighbor's property.

The tractor builder has been very satisfied with the hydraulic paint sprayer and possibility of a law suit by his neighbor has been eliminated.

What led to the development of this new sprayer?

It came about as a result of a recognized drawback in projecting paint with air, and that is that paint particles are carried along with the blast of air, therefore causing particles to ricochet and deflect and eventually find their way into the exhaust system causing tremendous waste. The paint loss due to overspray generally is 35 to 40% when spraying a solid area such as a wall and between 50 to 90% when painting such products as desks, chairs, washing machines and so forth.

Airless spray painting is predicated on harnessing entirely different forces of nature to accomplish breaking up the paint into particles.

With regular spraying, an external force, compressed air, converges with a stream of paint as it comes out of the fluid tip of the gun.

With Airless spray painting, internal forces of expansion are suddenly released. To accomplish atomization, two forces are harnessed. One is the mechanical force of a liquid released through a proper restrictive nozzle (as water from a garden hose).

The second force is vapor pressure that heats the paint to such a high temperature (180 to 200 degrees F for synthetic, and 160 degrees for lacquers) that a fraction of the solvent content is brought to the boiling point. However, upon release to the atmosphere, these solvents do not actually boil, but will burst into gas, thus affecting an additional breakup of the paint particles. This is the same action that takes place when a valve on a steam line is opened to atmosphere.

The equipment used in the Airless Spray Painting System is especially designed and consists of a positive displacement rotary pump driven by a ¾ hp explosion proof electric motor, a U. L. approved electric paint heater, and a specially designed spray gun. Practically all finishing materials can be

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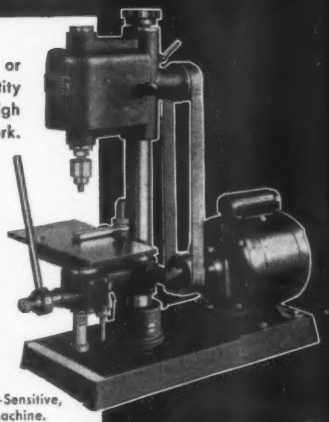

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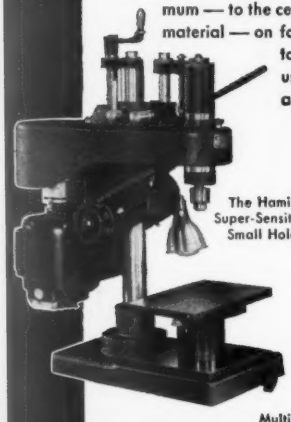
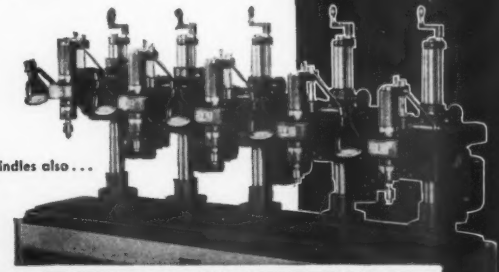


The Hamilton VARIMATIC® Super-Sensitive, Variable Speed, Small Hole Drilling Machine.



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sprayed by the process, including lacquers, synthetics, vinyls, wrinkles, liquid latex, etc. Material can be syphoned from a 5-gallon can or a 55-gallon drum.

"The general reaction in the paint industry is that airless spraying is a sensational, new, important development. Many leaders have expressed the thought that this will completely elevate the entire paint industry. The paint manufacturers have been constantly improving their product. However the application technique has been virtually at a standstill. This new process also will enable still greater improvements in formulation and utilization of raw materials which were applied previously under adverse conditions. This new process, in providing a better, more durable finish, is more economical.

As stated before, the biggest single advantage of this new method of spraying is the reduction in paint loss. An industrial installation utilizing standard painting methods has a great paint loss — on an average of 50%. This loss becomes extremely high when you figure an average gun sprays from 10 to 12 gallons per trigger hour. Under ideal conditions this loss can be cut down very effectively with Airless Spray painting.

Another important benefit is reduction in health hazards. With standard spraying processes, there are certain conditions of work such as painting inside of a cabinet or tool box, where it is unavoidable to have rebound of the spray "dust" striking the operator, regardless of how efficient the spray booth functions. In many industrial plants there are unavoidable conditions whereby the sprayer is literally covered with paint from head to foot before the working day is over.

A further important benefit is the elimination of a need for a huge exhaust system in a spray booth. Use of a booth is still recommended, but with a slight exhaust — just enough to take out of the spray area the solvent fumes released by the operation. Because no paint particles are blown out of the building, water wash systems in many instances can be completely eliminated.

Win Cash In Heli-Coil Design Award Program.

Six talented engineering students will receive cash awards as winners in the 1952-53 Heli-Coil Engineering Student Design Award Program.

The winning entries were picked by five nationally known men in the industrial design field at a recent judging session at the Wings Club, Biltmore Hotel, New York City.

Awards were made as follows: First award of $1000 will go to James D. Dunfee of the Drexel Institute of Technology. Second award of $500 was won by Joseph F. Klipp, of New York University's College of Engineering.

Because of a tie, duplicate third awards of $250 will be paid to both Warren C. Bross of the Newark College of Engineering and Robert W. Bradspies, a student at New York University's College of Engineering.

In addition, two students will receive merit awards of $100. They are Midshipman Ronald E. Adler, 1/c USN, of the U. S. Naval Academy and R. J. Murphy of Stevens Institute of Technology.

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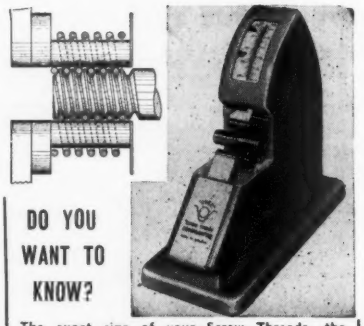

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A Reltool Saw for Every Need: In addition to Plain Metal Slitting Saws, Reltool makes Metal Slitting Saws with Staggered Teeth and Side Clip Clearance, Screw Slotting Saws, Formed Tooth Saws, Fine and Coarse Tooth Tenacious Saws, Plastic Saws, and Circular Shears.

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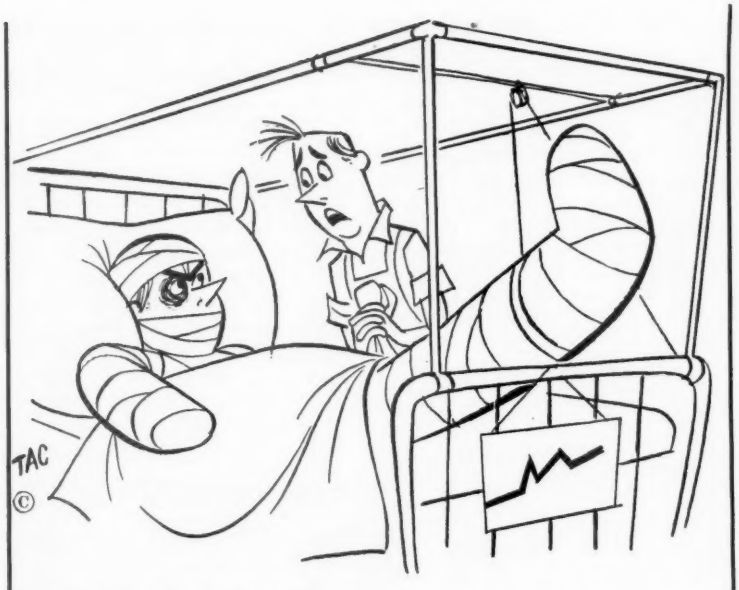

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Tool-Die Failures Pointed Out in Steel Firm Book

A practical handbook to help identify and correct the most frequent causes of tool and die failures has been published by a prominent manufacturer of tool steels. Titled, "The Tool Steel Trouble-Shooter," the book discusses fundamental factors such as good design, sound tool steel selection, correct heat treatment, proper grinding and proper application. Also, it identifies and analyzes 107 tool failure problems.

Such perplexing and difficult problems that lead to tool failures as improper tool design. faulty steel, faulty heat treatment, improper grinding and mechanical and operational factors, highlight the informative discussion on tool and die failures.

Each of the 107 typical tool failures analyzed is traced to its ultimate cause. These failures are classified into five groups to portray the shortcomings in each of the five essentials of successful tool making.

"The Tool Steel Trouble-Shooter" is generously illustrated with photographs selected from hundreds of case histories in the steel company's metallurgical files.

Rheem's One-Year Rocket Tube Story

From contract to full high production in one year . . . that is the achievement of tool engineers and production specialists at Rheem Manufacturing Co. in production of stainless steel rocket tube assemblies. With the contract, but no tooling or machinery to do the job, Rheem engineers launched a one-year development and tooling program that included the design and construction of various machines, and the development of numerous special processing techniques.

Among the problems faced were the meeting of complex specifications for armament requirements. the holding of rigid tolerances for interchangeability reasons, the elimination or correction of latent defects resultant from fusion and resistance welding methods, and the work-hardening characteristics of stainless steel.

Rocket tubes are assembled in two sections, consisting of a forward and aft tube. Forward tube production starts with blanking stainless steel sheet stock to size. This form is then broken in dies — three hits — to roll up the tube. Seams are poke-tack welded, followed by a continuous seam welding operation.

Rails for the rocket to slide on are then tacked to the inside of the tube, and an intermittent seam weld then applied. The forward tube is then hydraulically sized to final dimensions.

Aft tube production begins by blanking another piece of sheet stock, and breaking this form in dies — again three hits — to roll up the tube. An automatic heli-arc seam weld is then applied to close the tube. Next, one end of the tube is sized with a hydraulically-operated expanding mandrel. The other end is sized on the I. D. by burnishing. In the same operation, a carbide insert on the burnisher removes the inside flash of the weld.

All matching holes in both tubes are punched in one operation.

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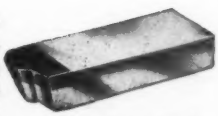
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Circular Form Tool

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1643 EDDY ROAD • CLEVELAND 12, OHIO
New Possibilities in Optical Grinding

Centerless Grinding With Abrasive Belts

Two coated abrasive belts are the elements of a new centerless grinder that removes 2 lbs. of stock from a 15 ft. length of 2.375 in. OD tubing in 2 minutes. The result of co-operative engineering between Behr-Manning Corporation of Troy, N. Y. and Production Machine Co. of Greenfield, Mass., the new process makes possible a grinding rate of cylindrical stock faster than any other method of precision grinding.

For Grinding Extruded Tubing

Although this method of grinding is adaptable for fast finishing of cylindrical stock of most materials, it was developed primarily for grinding stainless steel and other high alloy tubes produced by the Ugine-Sejournet extrusion process, in which the hot steel billet is forced through a Fiberglas lubricated die. Extruded tubing thus produced must be ground to remove the rough suface that results from the high extrusion pressures, and to remove taper from the cylindrical stock (up to 0.020 in. per 15 ft. length). Stock removal and not surface condition was the major consideration in finishing the extruded tubing, but 20 to 30 micro inch finishes are obtainable using fine grit belts. Tolerances of plus or minus 0.001 in. taper, end to end, are held.

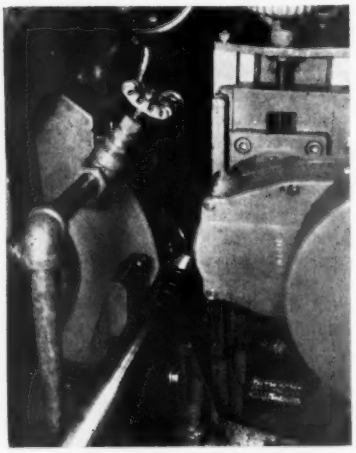

Fig. 2. Tubing moving into the grinding section of the abrasive belt centerless grinder. With the work rest positioned closer to the grinding belt than to the regulator belt, greater belt pressure is exerted on the work by the regulator belt which therefore controls work feed and rotation.

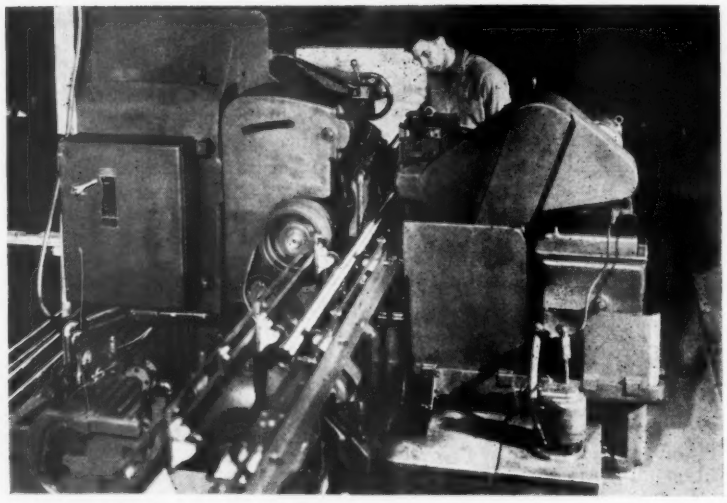

Fig. 1. Cylindrical stock finished with this centerless grinder is controlled and ground by two coated abrasive belts. Grinder designed for finishing tubing produced by the Ugine-Sejournet extrusion process.

Uses Two Abrasive Belts

Two coated abrasive belts are used on the machine. A 50 grit aluminum oxide waterproof cloth abrasive belt 9 in. wide and 168 in. long does the grinding. The work is fed past the grinding belt by a 220 grit aluminum oxide waterproof cloth abrasive regulator belt 9¾ in. wide and 58 in. long.

A cutting oil lubricates the grinding belt. Sprayed on the belt by a fan type nozzle, the recirculating lubricant flushes away the grinding swarf and prevents rewelding of the chips.

Grinding Belt on Steel Contact Wheel

A steel contact wheel mounted on a 4 in. shaft supports the grinding belt against the work. The use of steel contact wheels is a new concept in grinding with coated abrasive belts. In addition to backing up the belt, the steel wheel serves as the belt drive pulley. Driven by V-belts from a 25 hp electric motor, the 20 in. diameter wheel forces the belt past the work at speeds of 3500-10,000 sfpm. It is rigidly mounted in ball bearings to prevent deflection under the very high grinding pressures imposed on it. The steel contact wheel weighs approximately 350 lbs.

Adjustable Regular Belt

The regulator belt assembly consists of the coated abrasive belt, a variable speed drive, an idler pulley, and a flat steel back-up platen which holds the regulator against the work. This entire assembly can be adjusted about a horizontal axis to provide a work feed angle of from 0° to 15° in either direction from the verticle. This angular adjustment, together with the variable speed drive, makes pos-

. . . *Continued on page 110*

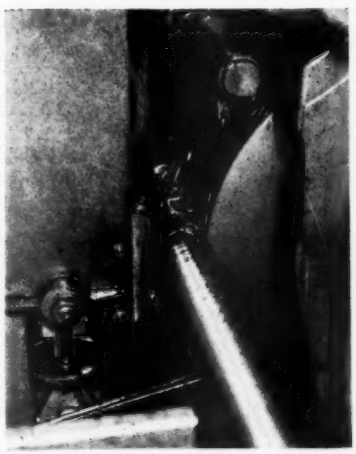

Fig. 3. Oil flows from the fan type nozzle above the work, onto the abrasive grinding belt. The grinding belt passes over the steel contact wheel at right and the regulator belt passes over the flat platen at left. Distance between the belts can be adjusted for tube sizes from one to six inches in diameter.

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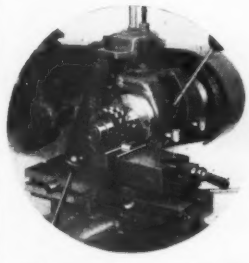

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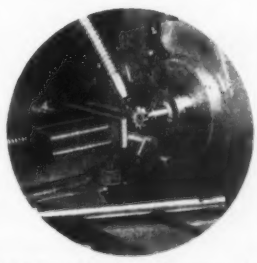
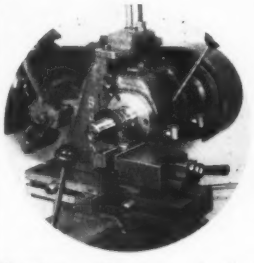


Milling Woodruff key-way in steel with standard cutter using up and down movement of head.



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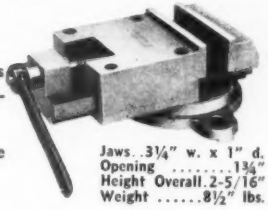

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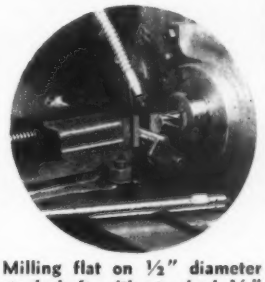

Milling flat on ½" diameter steel shaft with standard ½" end mill. Using up and down head movement.

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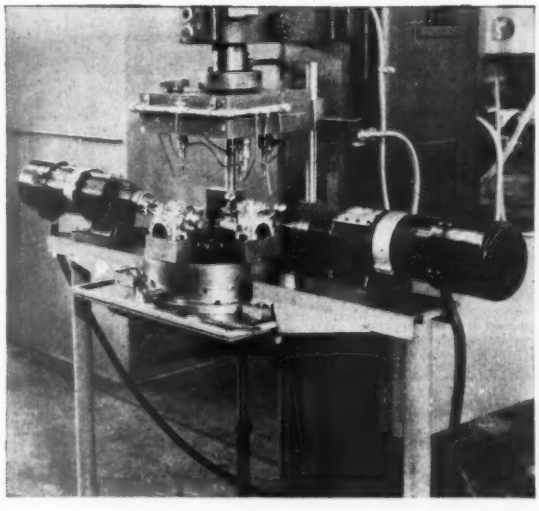

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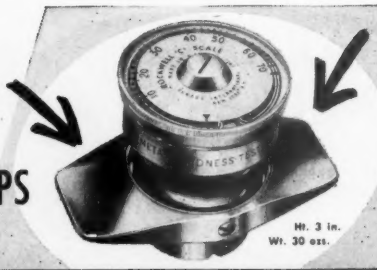

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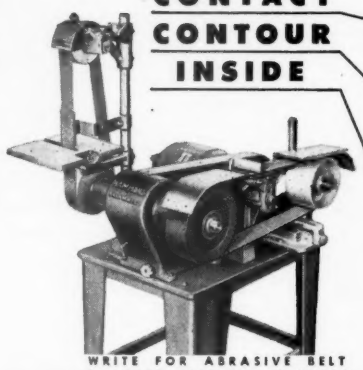

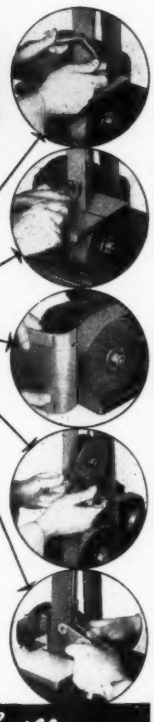

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Hammond Machinery Builders INC.

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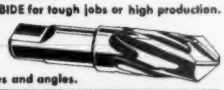

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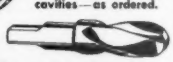
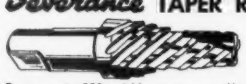


Severance TAPER REAMERS



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MEAD SPECIALTIES CO., Dept. HA-73, 4114 N. Knox Ave., Chicago 41, Ill.

New Die Lubricant Reduces Welding and Pickup

A new drawing compound known as Metalloid X-60 is reported to be increasing production on several installations, up to 8 times per die dressing. The better die life is achieved by limiting generated heat that causes welding and pickup on the dies. Applicable for both simple and reverse dies, X-60 also gives improved surface finish due to the elimination of pickup which causes scratches and scuffing of the shell.

Function of Metalloid X-60 in drawing operations is based on the Dynatomics Theory of limiting heat generated rather than relying upon heat transfer as do conventional die compounds. The active ingredients in the compound unite with the atoms in the workpiece to normalize the stressed section. The compound becomes active at a temperature of 550°, well below the critical temperature of dies and work.

Due to the absence of pigment, X-60 will not deposit or gum on presses or ways. Corrosion problems are eliminated, as the material does not break down and has a pH of 7. In numerous instances, X-60 has served as a protective coating when shells required temporary storage between draws. In multi-stage draws, requiring interim annealing, the compound eliminates subsequent cleaning operations as it burns off clean during the anneal without forming scale or other deposits.

The new compound has none of the characteristics of EP Lubricants which require special cleaning processes after drawing. Cleaning operations can be performed in any conventional manner in use by a plant, including vapor degreasing or caustic solutions.

Applications for Metalloid in drawing operations include all conventional metals from 1010 low carbon steel to stainless, including numerous non-ferrous materials. Lubricant is usually applied by dipping the blank prior to the first draw and dipping the shell after annealing in a multi-stage draw, or it may be atomized or sprayed on male and female dies. Dilutions are recommended according to the complexity of the draw, depth, etc. The product can be used in ratios up to 6 to 1, with any napthenic or paraffin oil base.

Of course, only one shop in a thousand needs these giant gages—but only one in a thousand has the experience and equipment for handling such precision. That's why Perfex is a better source for *all* your gage needs in thread rings and thread plugs, as well as specials. We still make 24 to 48 hour shipments on *most* standard thread plugs, from 0-80 NF to 1½"—6 NC, class 2 and 3. Our facilities include the finest grinding and checking equipment, operated under controlled temperature conditions, by a constantly growing force of the country's highest-skilled gage-makers. We're proud to offer you a superior product and service to match. Please write for copy of our new catalog and name of the Perfex representative near you.

Perfex also manufactures Tangi-Matic, the angle-tangent-to-radius dresser that eliminates height gages and "mikes"

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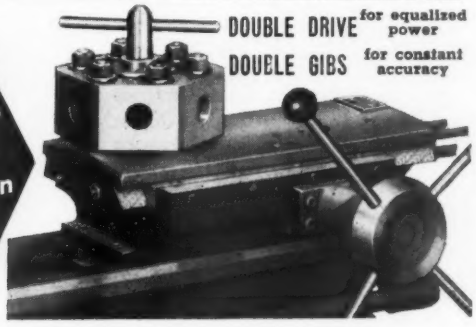

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Reasonable Deliveries

. . . Grinding, from page 106

sible an infinitely variable work piece feed rate from 0 ft/min to 30 ft/min.

Use of a coated abrasive regulator belt, operating over a rigid platen, offers a decided advantage over rubber bonded regulator wheels, as used in the conventional centerless grinders. The work feed angle of the coated abrasive regulator belt can be changed at will. A rubber bonded regulator wheel, on the other hand, must be reshaped whenever the work feed angle is changed.

Work Piece Control

The regulator belt, powered by a variable speed drive, controls the rotation of the work against the grinding belt. Control of pressure between work piece and regulator belt is maintained by placing the work rest closer to the grinding belt than to the regulator belt.

The regulator belt is ¾" wider than the grinding belt. The extra width of the regulator belt is extended on the infeed side of the machine in order to start the work piece rotating before it reaches the grinding belt.

Uniform Pressure Across Grinding Belt

By setting a small taper between the contact wheel spindle and the face of the back-up platen, a uniform rate of stock removal is maintained across the entire belt width. As a result of the uniform pressure across the face of the belt, dimensional accuracy is assured throughout belt life.

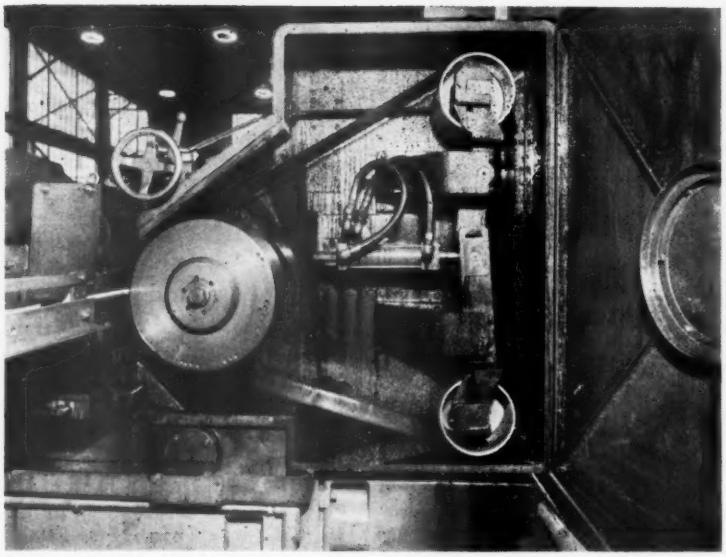


Fig. 4. Coated abrasive grinding belt passes over a steel contact wheel (at left) and two idler wheels. The lever mounted idler wheels maintain belt tension. Power to drive the belt is transmitted from a 25 hp motor by a multiple V-belt drive to the contact wheel.

Grinding Results

The main objectives of this method of grinding are: (1) to remove stock from the extruded tubing at a faster rate not obtainable by any other method of grinding; (2) to remove the Fiberglas skin and extrusion die marks; (3) to remove the taper from the tubing; and (4) to provide an acceptable finish on the tubing. Tests have demonstrated that the coated abrasive belt grinding process with cutting oil as a lubricant will accomplish these objectives.

Data compiled by the Behr-Manning Products Engineering Department indicates that the coated abrasive belt grinding process is economically practical. The figures on the chart in Figure 5 show results of a series of test runs made using one belt on 12 bars of Timken 52,100 alloy steel. The belt removed as much stock during the last pass of the twelfth bar as was removed during the first pass of the first bar.

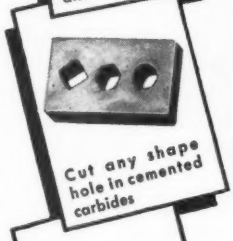
Because of the rigid construction of the machine, and its high ratio of horsepower to belt width (nearly 3 hp per inch of belt width) extremely high grinding pressures can be developed. Full advantage is taken of the inherent ability of coated abrasive belts to remove tremendous quantities of stock without overheating the work and causing burning, distortion and loss of dimensional accuracy.

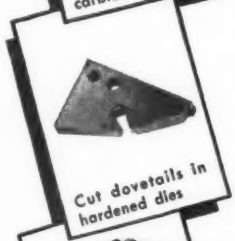
TUBE NO.	WT. BEFORE GRINDING	WT. AFTER GRINDING	TOTAL WT. LOSS	PASSES	CONDITIONS OF TEST
1	62 lb 10 oz	61 lb 6 oz	1 lb 4 oz	1	(1) Material Ground "Timken" 52100 Steel bars 3 in. OD 15 ft. Length
2	63 lb 12 oz	62 lb 11 oz	1 lb 1 oz	1	
3	64 lb 3 oz	62 lb 4 oz	15 oz	1	
4	63 lb 6 oz	62 lb 6 oz	1 lb	1	(2) Machine Production Machine Co. Type 914 Centerless Belt Grinder
5	61 lb 15 oz	60 lb 7 oz	1 lb 8 oz	2	Contact Wheel -- Steel
6	62 lb 14 oz	61 lb 3 oz	1 lb 11 oz	2	Feed Angle ½ Deg.
7	62 lb 9 oz	60 lb 15 oz	1 lb 10 oz	2	Stock Feed Rate 14.7 FPM
8	62 lb 8 oz	60 lb 11 oz	1 lb 8 oz	2	Grinding Speed 5100 S.F.P.M.
9	75 lb 2 oz	61 lb 6 oz	13 lb 12 oz	12	Taper on Platen 0.002 in./in.
10	72 lb 13 oz	60 lb 11 oz	12 lb 2 oz	11	(3) Results (Averages) Stock Removal Rate
11	74 lb 9 oz	61 lb	13 lb 9 oz	12	lbs. per pass 1.1
12	76 lb 8 oz	63 lb 1 oz	13 lb 7 oz	11	lbs per min 1.08
Total Figures on one belt			63 lb 7 oz (Total wt. loss)	and 58 (passes)	Micro-inch finish . . 20 rms

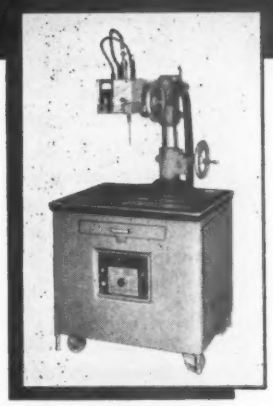
Fig. 5. Left. The figures on this chart show results of a series of test runs using one belt on 12 bars of Timken 52,100 alloy steel.

METAL DISINTEGRATION

and what it can do for you







Literally hundreds of thousands of dollars are saved annually by corporations that are using Metalmasters in just tool and die repair alone.

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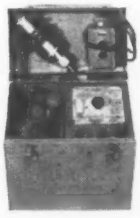

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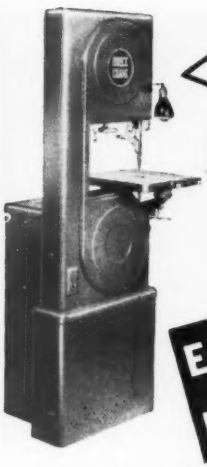

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50% thicker column (3/16" walls). Greater rigidity counts for closer precision at the chuck. 20% larger quill and deeper head reduces wear from side thrust on deep-hole drilling. 4" or more of the quill is ALWAYS supported. Rugged steel 6-tooth (involute) splined drive. Far more sensitive, powerful quill feed.

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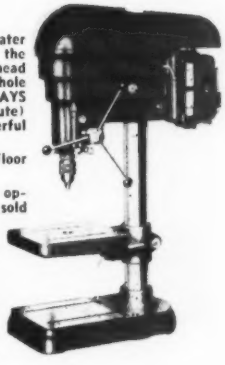

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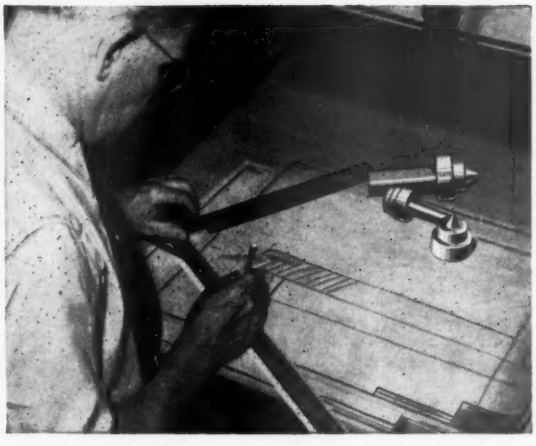

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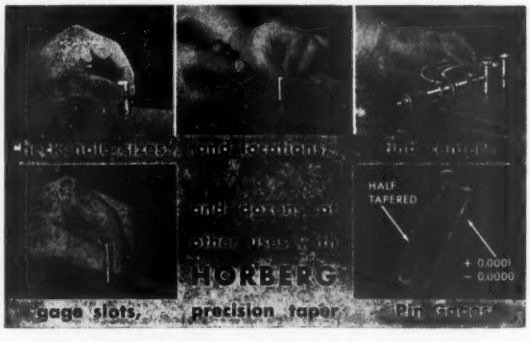

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Please Rush checked items and literature to
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. . . Automatic, from page 82

Conclusion

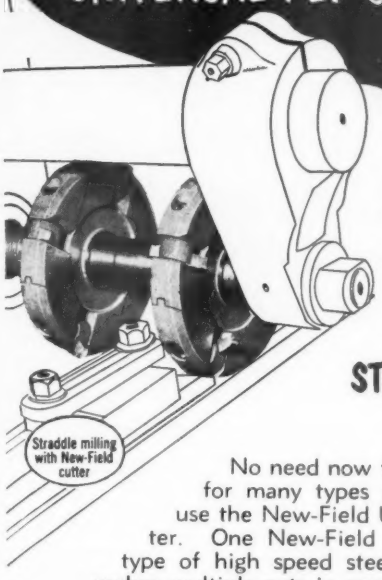
The Brown & Sharpe automatic screw machine is used extensively for the machining of small precision parts at L. F. & C.; the efficiency of operation being dependent to a large extent on the judicial choice and setting of the various tools that have been discussed. The design of this type equipment permits both a reliability of performance and simplified tool designs. In addition, settings and adjustment of tools can be quickly made and once the tool settings are established, a minimum of attention is required.

A large variety of materials can be machined; those factors of speed, feeds and depth of cut depending a good deal on the characteristics of the material to be cut. Thus, in the machining of the light metal alloys, maximum speeds can be frequently employed. This is also true on such specialty materials as the free machining low carbon steels identified by many trade terms; one being the 'E33'. Thus, our experience with this material has been quite favorable; however, due to the speed limitations of the older types of belt driven Brown & Sharpe equipment, full advantage of maximum speeds could not be realized. This was not true of the newer machines that we had on the floor. In any event, improved tool life resulted, especially on the older equipment where maximum speeds were not realized. Inherent properties such as exemplified by the 'cold working' properties of austenitic stainless steel also had to be considered; this material being cut at relative heavy feeds with slower speeds than that experienced in the cutting of other material. Thus, a knowledge of the characteristic behavior of the materials to be machined is of tremendous aid to the screw machine operator.

Tool material, of course, is a vital factor, regardless of type of material to be machined. Thus, on comparatively short runs, the carbon tool steels often perform satisfactorily. However, the high speed steels are a favorite tooling material, especially where medium to long production runs are to be anticipated. Within this high speed steel catagory, both the tungsten and the molybdenum high speed steel compositions are the favorite; the latter mentioned analysis being more frequently used today due to the restrictions levied upon tungsten. The high speed steels have the advantage in

. . . Continued on page 148

New-Field
UNIVERSAL FLY CUTTER



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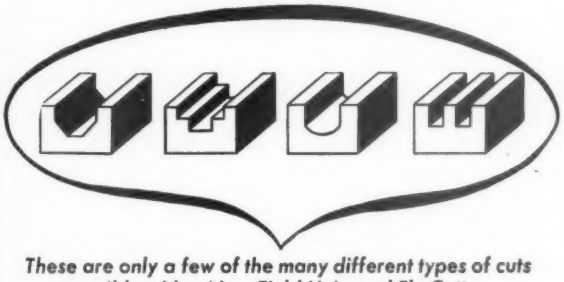
USES STANDARD BITS!

No need now for special cutters for many types of milling if you use the New-Field Universal Fly Cutter. One New-Field cutter using any type of high speed steel or carbide bits makes multiple cuts in one operation. Standard bits are easily reground or replaced when needed for other work. Down time is cut to minimum.



These are only a few of the many different types of cuts possible with a New-Field Universal Fly Cutter.

New-Field Cutters fit all standard arbors on horizontal or vertical mills or drill presses, turn to any required speed, have adjustable bits to permit slots of any shape from 3/16" to 2" for fly cutting, slotting, surface and straddle milling, gear cutting, disc and gasket cutting. Available in 4", 6", 8" and 10" sizes, also 6" and 8" heavy duty size designed especially for Shell End Mill Arbors. Write today for details on this versatile, money-saving tool!

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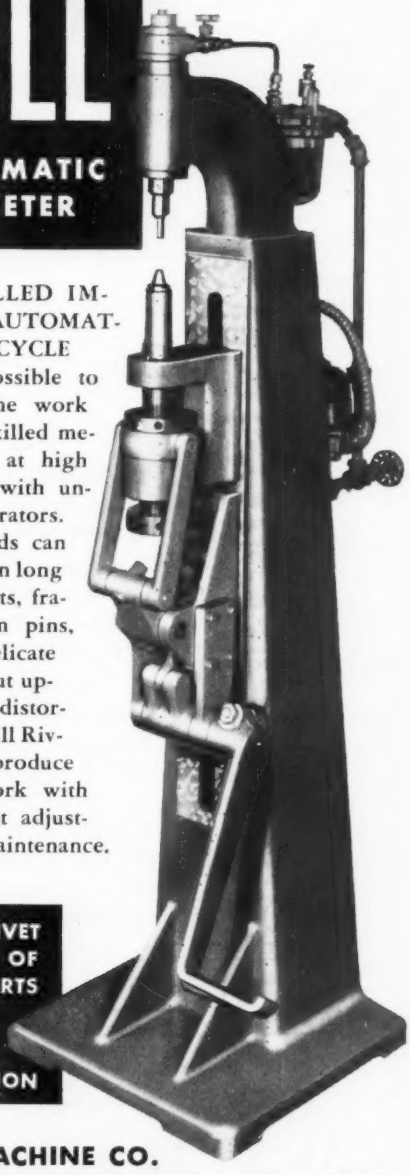

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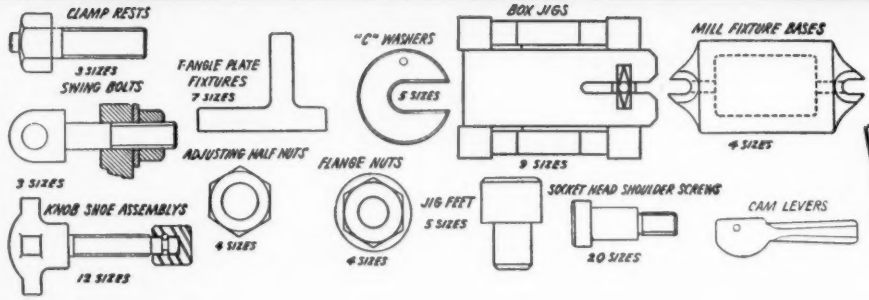

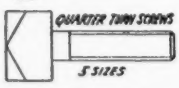

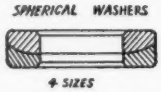

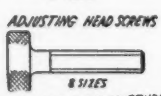

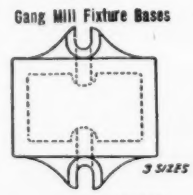

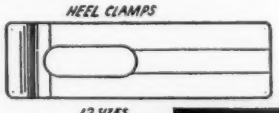

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3	19	35	71	83	98	108B	120A	128A	133D	138D	143A	146A	150B	154A
4	20	36	72	84	99	108C	120B	128B	134A	139A	143B	146B	150C	154B
5	21	37	73	85	100	108D	121	128C	134B	139B	143C	146C	150D	154C
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8	24	59	76	88	103	111A	122C	130C	135B	140C	144C	147B	151A	155A
9	25	61	77	89	104A	111B	124A	131A	136A	140D	144D	148A	151B	155B
10	26	63	78	90	104B	112A	124B	131B	136B	140E	144E	148B	151C	157
12	28	64	79	91	104C	112B	125	132A	136C	140F	145A	148C	152A	158
13	29	65	80	92	104D	113A	126A	132B	136D	141A	145B	148D	152B	
14	30	66	81	93	104E	113B	126B	132C	137A	141B	145C	149A	152C	
15	31	67	82.1A	94	105	114	126C	132D	137B	142A	145D	149B	152D	
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4	20	36	72	84	99	108C	120B	128B	134A	139A	143B	146B	150C	154B
5	21	37	73	85	100	108D	121	128C	134B	139B	143C	146C	150D	154C
6	22	38	74	86	101	109A	122A	130A	134C	140A	144A	146D	150E	154D
7	23	40	75	87	102	109B	122B	130B	135A	140B	144B	147A	150F	154E
8	24	59	76	88	103	111A	122C	130C	135B	140C	144C	147B	151A	155A
9	25	61	77	89	104A	111B	124A	131A	136A	140D	144D	148A	151B	155B
10	26	63	78	90	104B	112A	124B	131B	136B	140E	144E	148B	151C	157
12	28	64	79	91	104C	112B	125	132A	136C	140F	145A	148C	152A	158
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15	31	67	82.1A	94	105	114	126C	132D	137B	142A	145D	149B	152D	
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A3	A16	A29	A42	B13	B26	B39	B52	B65	B78	B91	E3	E15
A4	A17	A30	B1	B14	B27	B40	B53	B66	B79	C1	E4	
A5	A18	A31	B2	B15	B28	B41	B54	B67	B80	C2	E5	
A6	A19	A32	B3	B16	B29	B42	B55	B68	B81	C3	E6	
A7	A20	A33	B4	B17	B30	B43	B56	B69	B82	C4	E7	
A8	A21	A34	B5	B18	B31	B44	B57	B70	B83	C5	E8	
A9	A22	A35	B6	B19	B32	B45	B58	B71	B84	C6	E9	
A10	A23	A36	B7	B20	B33	B46	B59	B72	B85	C7	E10	
A11	A24	A37	B8	B21	B34	B47	B60	B73	B86	C8	E11	
A12	A25	A38	B9	B22	B35	B48	B61	B74	B87	C9	E12	
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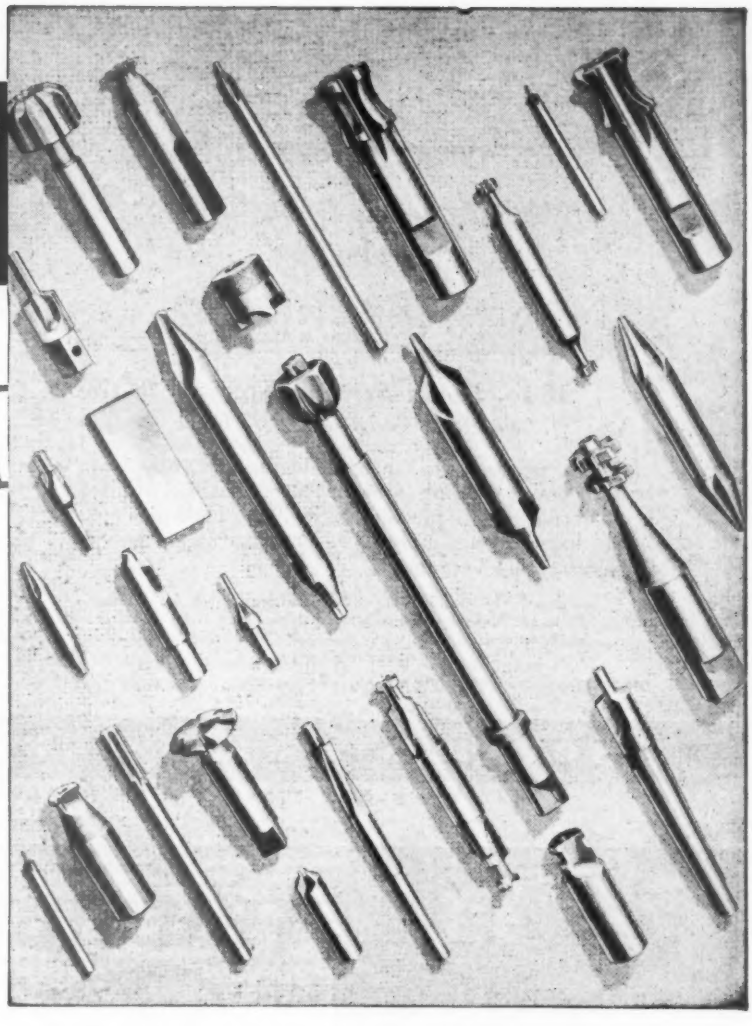

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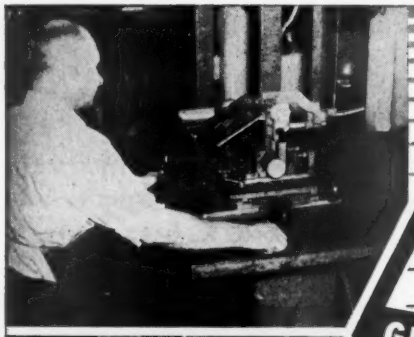

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for trimming castings of all metals write for bulletin on "Foundry Band Saws".

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The TANNEWITZ WORKS GRAND RAPIDS MICHIGAN

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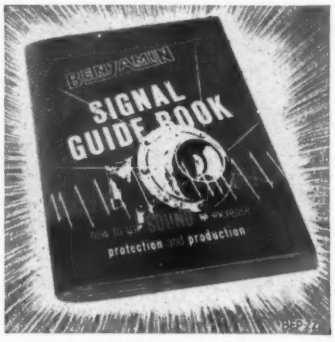
INDUSTRIAL SOUND SIGNALS

A manual that promises to become a standard reference work in its field has been prepared by Benjamin Electric Mfg. Co., Des Plaines, Ill. When preparation on the manual began, it was discovered there



was practically no literature on the subject of Sound Signals and the book had to be created almost "from scratch". Some of the subjects covered include a simplified explanation of Fundamentals of Sound, a glossary of signal and sound terms, a quick-comparison guide for selecting signal equipment, nine suggested steps in choosing a signal installation and hints for compiling a coding signal call system.
Circle Inform-A-Gram No. C1.

"PRINCIPLES OF HEAT TREATING" is a new booklet that explains in detail, through the use of numerous charts and photographs, the process of annealing, hardening, martempering, austempering and surface hardening. Equilibrium diagrams, dilation curves, "S" curves and Jominy curves with their explanations are included. Booklet available from Meehanite Metal Corp., 714 North Ave., New Rochelle, N. Y.
Circle Inform-A-Gram No. C2.

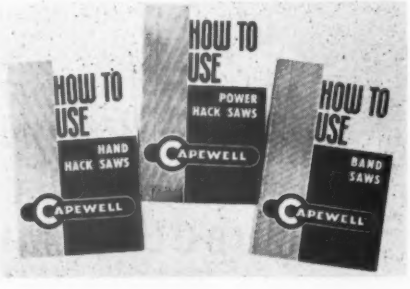
Culminating More Than Two Years of Field Research, the Capewell Mfg. Co., 60 Governor St., Hartford, Conn., has just released three information booklets on the selection and use of hand hack saws, power hack saws and band saws. Each booklet is a complete unit in itself and is written in a concise, easy to understand style.
Circle Inform-A-Gram No. C3.

Selecting Proper Taps and using them to their fullest efficiency is the discussion offered in "Facts about Taps and Tapping." Presented by Greenfield Tap & Die Corp., Greenfield, Mass., the illustrated booklet holds a huge quantity of information for shopmen, designers, students, salesmen and others associated in some way with taps. The handbook serves as a suggestive guide towards the solution of every day problems concerning taps and is published by a firm with much experience in that field. Also included is a section devoted to tools for cutting screw threads.
Circle Inform-A-Gram No. C4.

ALLOY SPRING STEEL. Eighteen pages with charts, tables and photomicrograph. Booklet compares mechanical properties of three alloy steels—nickel-chromium-molybdenum and silico-manganese with plain carbon steel. Printed by International Nickel, 67 Wall St., New York 5, N. Y.
Circle Inform-A-Gram No. C5

Barrel Finishing Processes are discussed in a 16-page manual now available through Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul, Minn. Use of the "Honite" barrel finishing method, a low pressure, random honing process for deburring and burnishing small metal parts, is discussed in detail in the illustrated booklet.
Circle Inform-A-Gram No. C7.

Vacuum Metallurgy is an established low cost process for industrial finishing. The National Research Corp., 70 Memorial Drive, Cambridge, Mass., offers reprints of a recent article describing the use of the vacuum metallizing process in manufacturing both plastics and metal parts. The article covers all factors regarding finishing or coating problems.
Circle Inform-A-Gram No. C8.



Helpful Hints on heat treating tool steel is the theme of a new bulletin released by the K. H. Huppert Co., 6839 S. Cottage Grove Ave., Chicago 37, Ill. It is written to help small machine tool and die shops who do not have trained metallurgists but want to do their own heat treating.
Circle Inform-A-Gram No. C6.

When Is A Metal Considered Ideally Weldable? This and other questions on arc welding process is answered in a direct reprint of Chapter II of "Procedure of Arc Welding Design and Practice," published by the Lincoln Electric Co., Cleveland, Ohio. Price of the booklet is 50 cents.

MORE THAN 300 TECHNICAL CASE HISTORIES and general information articles on industrial instrumentation covering all major industries are listed in a special index published by Industrial Division of Minneapolis-Honeywell Regulator Co., Wayne & Windrim Aves., Philadelphia 44, Pa.
Circle Inform-A-Gram No. C9.

Failure of a Punch is attributed to poor material, hardening or workmanship too often when in reality the cause in most cases is due to such factors as lining up punch and die, lubrication, stripping, loose nuts and stems, hard material, ripping and multiple work. The Cleveland Punch & Shear Works Co., St. Clair & East 40th St., Cleveland 14, Ohio, is offering a chart on the proper care of punches and dies. The instructions are applicable to fabricators of plates and structural shapes as well as tool and die shops.
Circle Inform-A-Gram No. C10.

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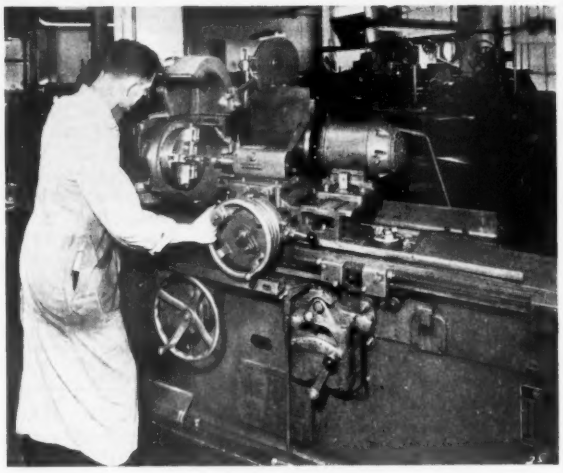

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. . . Cut Length Control, from page 49

upon the dial indicator. By initially setting the needle of the dial indicator at the limit value desired, the completion of the supplemental cutting operation is shown on the dial indicator when the needle swings to zero.

This same indicator setting will hold for a series of supplemental cuts on a work piece when the required limits are the same. Upon completion of the supplemental cutting operation in one given case, the tool holder will be manually moved backwards until the indicator needle returns to the initial setting and the indicator spindle is in contact with the ring plate. Thus, the complete setting is the same as at the beginning of the previous supplemental cutting operation.

The same manipulation as just described can be repeated with as many successive cuts as may be desired, since each of the stop screws (F) corresponds to a given length of cut. The further cutting by the manual operation will be the same for all of the series of cuts and will correspond to the same setting of the dial indicator needle. The supplemental cutting operation may be of any amount desired for any given series of pieces of work.

In the regular operation of the conventional turret lathe, the stop ring (H) is automatically turned with the turning of the tool-holder or head (A) by manipulation of the hand wheel (W). This wheel is turned so as to bring the proper stop screw into operative position with the corresponding

. . . Continued on page 125

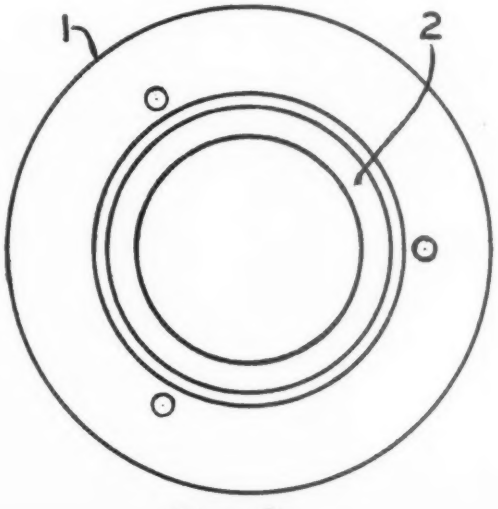
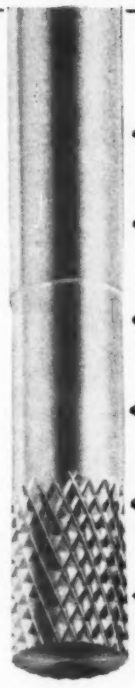


FIG. 3

Fig. 3. A detailed view of the ring plate against which the indicator point makes contact.



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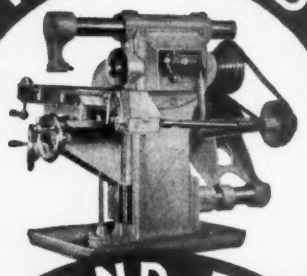

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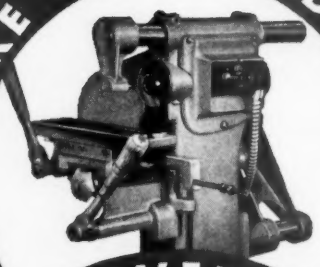

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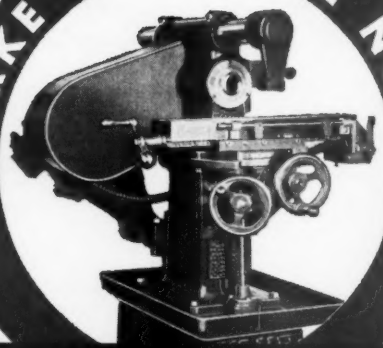

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METAL CUTTING TOOLS

The Complete line of Lovejoy milling cutters is displayed in this handsome illustrated brochure. Also included is information on mills for every requirement applicable to inserted blade design.
Circle Inform-A-Gram No. E1.

DIAL INDICATORS

The L. S. Starret Co. wishes to call your attention, in this booklet, to its complete line of indicators, commonly referred to as dial gages. Included in catalog are actual size illustrations.
Circle Inform-A-Gram No. E2.

SURFACE GRINDERS

Jones & Shipman Hydraulic surface grinders are in operation in all parts of the world. A British Industries Corp. bulletin lists the many features of this machine and other pertinent information.
Circle Inform-A-Gram No. E3.

FINISHING INDUSTRY

A new Pelron brochure describes, in detail, services offered the finishing industries. Bulletin explains how Pelron studies lead to development of compounds to handle various difficult jobs.
Circle Inform-A-Gram No. E4.

PNEUMATIC RIVETERS

Check the many Airflex riveter features in this Qic-Pic catalog offered by Lemert Engineering Co. Chart included shows how Airflex equipment solved many tough riveting problems.
Circle Inform-A-Gram No. E5.

"O" RING GAGES

Reliant Gages are the subject of this new bulletin, which has complete specifications and data on "O" ring gages and other precision instruments. Catalog is generously illustrated.
Circle Inform-A-Gram No. E6.

TAPPING ATTACHMENT

A new product of the Boyer-Schultz Corp., the lead screw tapping attachment, is fully described in this informative and illustrated brochure. Included are nomenclature and specifications of machine.
Circle Inform-A-Gram No. E7.

STAINLESS STEEL BARS

The first edition of a complete new technical book on stainless steel bars is available from Allegheny Ludlum Steel Corp. Included is section on fabrication and processing plus reference tables.
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END MILLS

Pohl Tool Co., manufacturers of high speed and special tools presents a comprehensive discussion on its products. Complete data includes specifications with each item mentioned.
Circle Inform-A-Gram No. E9.

LIQUID SALT BATHS

The many advantages of using salt baths in the heat treatment of metals are fully explained in this bulletin which is a publication of the metal research staff of E. F. Houghton & Co.
Circle Inform-A-Gram No. E10.

RESISTANCE WELDING

Newly designed welding tips are included in the resistance welding bulletin just released by Ampco Metal Inc. Booklet includes reference tables and comparative charts.
Circle Inform-A-Gram No. E11.

CAST PLATE AND BAR

Reynolds' aluminum cast plate and bar for machine shops first proved their superiority in the aircraft industry. What the product has been used for since, plus other data available in new Reynolds' Metal Co. booklet.
Circle Inform-A-Gram No. E12.

METAL-SHAPING

This guide is published for the designer, engineer or industrial executive and reveals the many new applications of the Koldflo method of metal-shaping and industrial design. Released by Mullins Mfg. Corp.
Circle Inform-A-Gram No. E13.

OPTICAL PROJECTION

A Stocker & Yale brochure contains 10 application stories covering optical projection problems, plus a short course in the how and why of optical projection.
Circle Inform-A-Gram No. E14.

MOTORS AND GENERATORS

A motor and generator reference booklet to assist in the selection of motive power to handle industrial applications is offered by Allis-Chalmers Mfg. Co. Text and photos on integral hp motors and generators included.
Circle Inform-A-Gram No. E15.

MILLING CUTTERS

Millit Div. of Kraus Design, Inc., is introducing a new line of milling cutters entirely different from anything now on the market. Primary features and other data completely presented.
Circle Inform-A-Gram No. E16.

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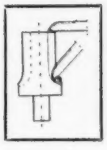

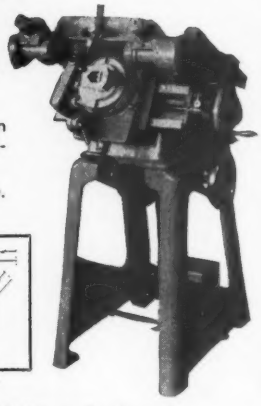

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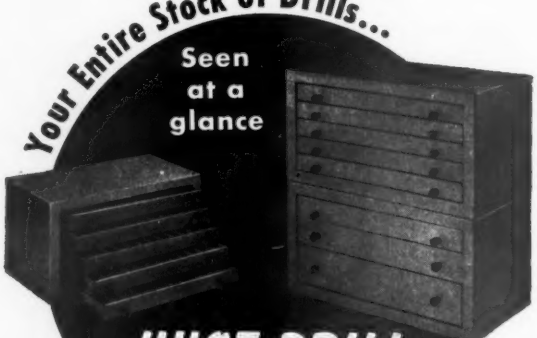

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Huot is pronounced "Hew-ot"

. . . Power Brushing, from page 53

surfaces of 8 micro-inches, or less if necessary, while removing burrs. Hard cord brushes used in finishing stainless steels have much less tendency to develop drag lines than do conventional methods. The fast cutting action and firm cushion of these cord brushes, used with a suitable compound, permits production of a superior finish with fewer wheel passes.

The treated fiber brush finds an important place in surface blending prior to plating. Here, the capacity for fast cutting inherent in this type of brush enables the surface to be uniformly brushed, thereby blending imperfections so that a satisfactry uniform plate may be obtained at minimum cost. There is no need for cutting an entire surface down to the depth of the deepest surface imperfactions.

A comparison of photomicrographs made from surfaces produced by a conventional polishing wheel and then refined by power brushing, emphasizes the reduction in surface imperfections as revealed by the improved surface appearance. This improvement is readily substantiated by a comparative study of charts showing the surface roughness as measured by a Brush Surface Analyzer.

The cushion or flexibility of a brush is infinitely greater than grinding wheels, for instance. When a centerless grinder becomes unsuitable for use as a grinder, it is usually satisfactory for centerless brushing. Grinding must be done with the running truth of the wheel held constant, within fractions of a thousandth, regardless of cutting pressures; whereas, a brush has sufficient cushion to take up several thousandths of inaccuracy without producing a measurable difference in surfaces produced.

A major advantage of power brushing is the relatively low cost of brushing machines and the companion possibility for varying degrees of mechanization ranging from strictly off-hand work to fully automatic equipment, depending upon the volume and rate of production required.

Brushes and brushing equipment constitute important production tools, because they fit into those areas of manufacturing where the ratio of labor cost to other production costs is traditionally very high. The production yield of a brushing operation is directly influenced by the design of the machine. For example, a simple work fixture for presenting the part to a rotating brush would result in a probably satisfactory, but relatively low, production yield. On the other hand, completely

automatic equipment which feeds parts and moves them through one or more brushing stations is capable of very high production, 1000 to 2000 parts per hour not being uncommon.

In any event, well designed machines permit brush finishing at rates comparable to or better than those of other related manufacturing operations. Good machine design especially permits a reduction in **skilled** labor requirements.

. . . Cut Length Control, from page 121

tool on the head (A). By virtue of the particular form and manner of mounting the ring plate (1 and 2) it will be turned with the ring (H) and there will always be maintained the operative relation between the indicator spindle and the ring plate (1).

The ring members (1 and 2) may be of the same inner diameter and the ring member (2) may be of substantially the same outer diameter as that of the stop screw ring (H). The indicator spindle will clear the edge of the ring member (2) as well as the binder nuts (J) of the stop screws (F). The conventional stop screw ring (H) has sufficient margin outside of the stop screws (F) to permit engagement of the ring member (2) and there is also sufficient space at the rear side of the stop screw ring (H) for engagement of the clamping bolts (3).

This attachment may be applied to the conventional turret lathe without any change in its structure or operation and is capable of increased accuracy in the performance of the cutting operation. Tolerances from 0.001" to 0.0001" can be held depending on the scale of the dial indicator used.

G-E Movie Wins Award

"Freedom and Power", a General Electric Company motion picture that depicts the importance of electric power in the American economy, recently won the Minister of Communications Award at the 1953 International Milan Samples Fair in Milan, Italy.

Released by G. E. last year, the 16-mm, sound-color production was designed as a public-information vehicle to give people a better understanding of electricity's role in national welfare and security. It is the latest presentation in G. E.'s More Power to America series of visual programs dedicated to the improvement of our way of life.

Written to appeal to all types of audience, the movie has been made available the electric utility companies, etc.

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Then you can finish grind in hardened steel to "tenths" . . . jig grind dowel holes square with a ground base . . . move location of holes in hardened steel blocks . . . jig grind interchangeable holes in hardened sections . . . grind small holes with diamond impregnated mandrels . . . grind contours and relief with tungsten carbide burrs . . . grind radii in die sections . . . eliminate jig bushings in tools where close spacing is essential.

Other infinitely controlled air driven spindle applications

Place spindle on most any machine. Use it for finishing contours on hardened steel working surfaces . . . burring or milling die castings . . . routing wood contours . . . carbide milling or finishing slots . . . finishing holes in hardened steel to "tenths" . . . grinding with diamond wheels, carbide burrs, or diamond impregnated mandrels.

Advantages—10 micro finishes using carbide mills . . . 6 micro finishes using mounted points, operates at any angle . . . air driven, air cooled, overheating prevented . . . speed controlled at optimum point . . . 3⅛" long motor uses little working space . . . By controlling speed at any point you abolish need for many constant speed spindles.

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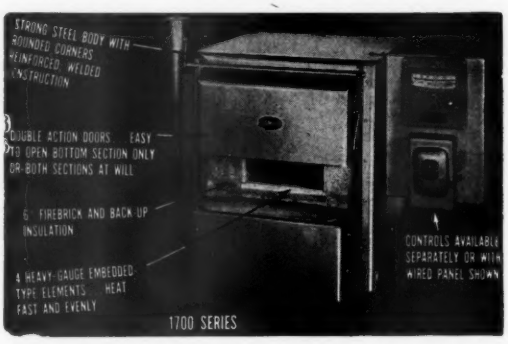
. . . with this versatile Temco bench furnace

. . . for heat-treating dies, parts, tools, etc.


STRONG STEEL BODY WITH ROUNDED CORNERS REINFORCED WELDED CONSTRUCTION
DOUBLE ACTION DOORS EASY TO OPEN BOTTOM SECTION ONLY OR BOTH SECTIONS AT WILL
6" FIREBRICK AND BACK UP INSULATION
HEAVY-GAUGE EMBEDDED TYPE ELEMENTS HEAT FAST AND EVENLY
CONTROLS AVAILABLE SEPARATELY OR WITH WIRED PANEL SHOWN
1700 SERIES

Speed production, lower unit costs with this husky electric furnace. Large enough to take a wide variety of work, yet compact and exceptionally convenient to use. Chamber sizes--9½" wide, 8½" high and 13½" or 18" deep. Heating range 350° to 1900° F., 220 V. operation. Price with controls, $297.50 to $507.50. Furnace only $235 to $285. Write for literature and nearest dealer's name.

TEMCO® ELECTRIC FURNACES

Thermo Electric Mfg. Co., 474 Huff St., Dubuque, Iowa

RAYMAC

Solid Carbide

DRILLS and REAMERS

RAYMAC drills cut hardened metal . . . do not burn or anneal. Feature operational speeds of 350 to 600 RPMs depending on size and hardness of metal.

RAYMAC solid carbide reamers are custom designed for individual jobs. Our engineering department is at your service to solve your reaming problems.

Write for catalog No. 12.

RAYMAC

MANUFACTURING COMPANY INC.

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RING PUNCHES

•

HARD... tough . . . concentric . . .

Precision-made of both Carbon Vanadium and high carbon, high chrome steels. Available in a wide range of stock sizes from 1/32" to 1" point diameters in increments of 1/64" for immediate delivery. Decimal sizes to order for delivery within 48 hrs.

Button Dies

Ring Type or Press Fit

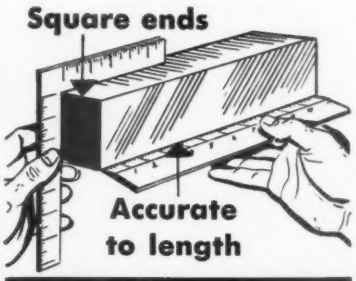
Hole tapered to eliminate slug jamming. Sizes in stock to match punch sizes.

Write TODAY for your copy of handy data sheets covering specifications and prices; also name of distributor in your area.

Exclusive Distributor Wanted for the States of Washington and Texas

Ring Punch & Die Co.

108 FOOTE AVE., JAMESTOWN, N. Y.



with MOTCH & MERRYWEATHER Triple-Chip cut-off saws

Ask for our Circular Sawing Handbook.

Segmental – 11" through 108" dia.
Solid – 8" through 20" dia.

Down with scrap! Up with usuable production! Whatever the material or shape or size, Motch & Merryweather has a segmental or solid blade for the job. You get highest practical speeds, ends square and burrless, cut-off pieces meeting close tolerances. Resharpen repeatedly at low cost. Obtain Triple-Chip long life and economy.

INVESTIGATE, TOO, THIS VALUABLE AID TO PRODUCTION

DISTINCT ADVANTAGES

For the most favorable results, time- and profit-wise, use Motch and Merryweather's superb coolant. Anti-weld averting pickup. Sharper tools and longer-lived. Oily, but not "greasy". Smokeless, odorless. A real aid to money-making production.

* * *

THE MOTCH & MERRYWEATHER MACHINERY CO.
715 PENTON BUILDING
CLEVELAND 13, OHIO

Triple-Chip METHOD
REMEMBER — IT'S THE COST PER CUT THAT COUNTS!
Only TM a TK builds ALL 3: CIRCULAR SAW BLADES, BLADE GRINDER

Piercing Stainless Steel Rings

To simplify performance of piercing operations on heavy stainless steel rings, and at the same time facilitate loading and unloading of the heavy work pieces, an eastern manufacturer has built and equipped a special 32-ton capacity horizontal power press.

The press pierces 64 slots in 40 seconds in a jet engine vane ring for the airfoil blade. The fully automatic piercing operation is accomplished by two slides, adjustable to punch either outside-in or inside-out. The ring measures approximately ⅛ inch thick, 3½ inches high, and 32 inches in diameter. Loading and unloading floor-to-floor time is one-and-one half minutes per piece.

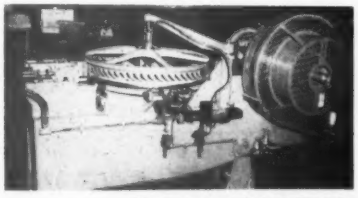


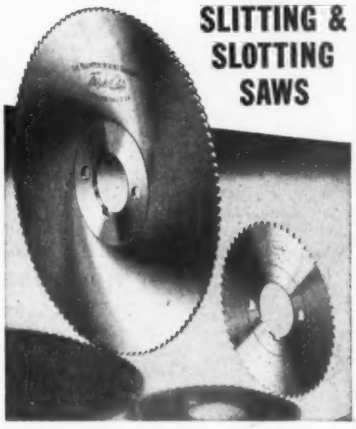
Photo courtesy V & O Press Co.

The press is equipped with an air clutch and special indexing fixture, with complete electro-pneumatic control. Factors which influenced adoption of the horizontal position included ease of loading and unloading and the problem of keeping the heavy piece in position during operation.

A simple operating sequence makes running the press easy. After placing the ring in position, the operator presses a button. From then until the piece is ready for removal the operation is automatic.

When the button is pressed an air-operated hold-down swings into position, then moves down and clamps on the ring. When the hold-down reaches the "down" position, the press starts automatically. The press performs the exact number of strokes, controlled by a Cyclo-Monitor counter. After the last stroke, the press stops, the hold-down raises automatically and swings away. The finished vane is then ready for removal.

NO CLOGGING — NO BINDING — with MOTCH & MERRYWEATHER Triple-Chip SLITTING & SLOTTING SAWS



The Motch & Merryweather Triple-Chip Method clears the way to faster results in milling operations. Alternately ground paired high and low blade teeth form curling, self-clearing chips which relieve stresses and minimize breakage. Saws produce more work and more accurate work and "live longer".

* * *

DUAL DRIVE.. for More Power to Your Blades!

Dual Drive is available on all M. & M. slitting saws.

Motch & Merry·eather Dual Drive construction makes keyways unnecessary. Two pins drive the saw blade and eliminate stresses at the drive point. The Dual Drive adaptor is keyed to the arbor, thus permitting a wide interchangeability in saws.

* * *

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715 PENTON BUILDING
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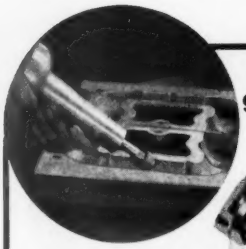
Triple-Chip METHOD
REMEMBER — IT'S THE COST PER CUT THAT COUNTS!
Only TM a TK builds ALL 3: CIRCULAR SAW BLADES, BLADE GRINDER



gives you the speed

and power you need

for faster, easier grinding

Onsrud Air Turbine Grinders give speeds up to 75,000 RPM, with ample power to hold rated speed under full load. No slow-up to wear out wheels and patience. High speed lets you use small, lower cost wheels. Air turbine motors always run cool. Light in weight. Grease packed bearings save time on tool maintenance. For information, write for Grinder Bulletin 1129.

ONSRUD MACHINE WORKS, INC., 3941 Palmer St., Chicago, 17, Ill.

YOUR CHOICE OF THREE DIFFERENT SIZES

B-1B AIR TURBINE GRINDER 75,000 RPM

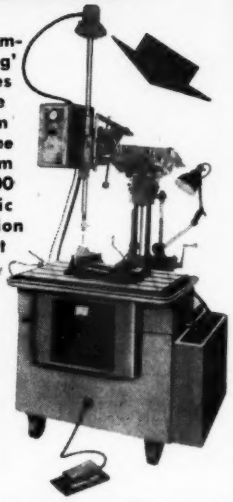
D-1A AIR TURBINE GRINDER 50,000 RPM

E-1A AIR TURBINE GRINDER 38,000 RPM

Onsrud® America's leading AIR TURBINE TOOLS

DRILL HOLES AS SMALL AS .030″ IN ANY METAL OF ANY HARDNESS OR THICKNESS!

The M-300 Elox Electron Drill* combines the best in the 'arc machining' process. In addition to drilling holes as small as .030″ it is adjustable for machine finishes ranging from *coarse, fine, extra fine and super fine* ...on any metals from magnesium to cemented carbide. The M-300 with exclusive Elox Automatic Feed allows for continuous operation with much of the human element removed. Using electrodes costing less than 3¢ per inch, with 'super fine' cutting, 1″ of electrode will cut as much as 33″ of hardened steel! Here indeed, is a dual-purpose machine that is being used for production machining of hardened steels and for removing broken drills in salvage. Write today for details and list of users.

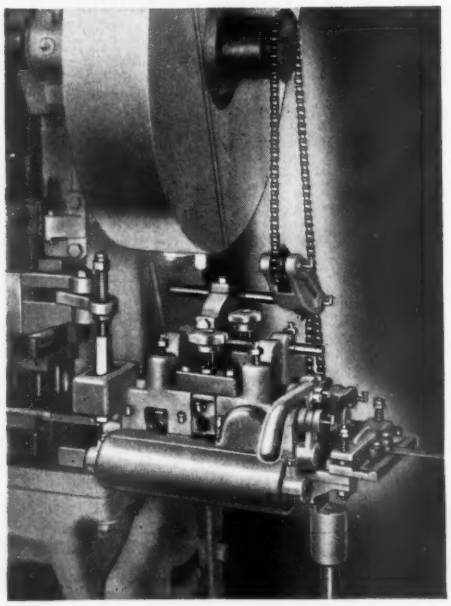


ELOX CORPORATION OF MICHIGAN

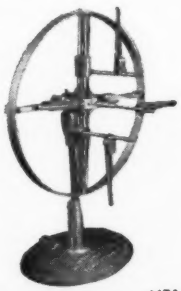
740 N. ROCHESTER RD. • CLAWSON, MICHIGAN

GET *RAPID-FIRE PRODUCTION from your PUNCH PRESSES*

IT'S EASY WITH **WITTEK Automatic Roll Feeds**



Step up production by making your punch presses automatic! Wittek automatic roll feeds fit all makes and sizes of punch presses — provide maximum efficiency and extreme accuracy in the high-speed automatic feeding of strip stock. They are made in single roll, double roll, and compound types with straighteners, in models to feed (push or pull) in any of four directions. Length of feed is quickly and easily adjusted to meet individual job requirements.



WITTEK Reels Stands

Simplify Handling of Coiled Stock

A choice of standard models is available to facilitate handling a large variety of coiled stock . . . from small, light coils to those weighing up to 800 pounds. These larger reel stands automatically center the coils and provide frictional braking action to prevent overrunning and maintain uniform coil slack.

Write for full particulars

4474

WITTEK Manufacturing Co.

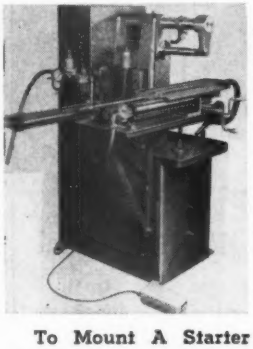
4323 W. 24th Place, Chicago 23, Illinois

Automatic ROLL FEEDS AND REEL STANDS

PROGRESS ON PARADE

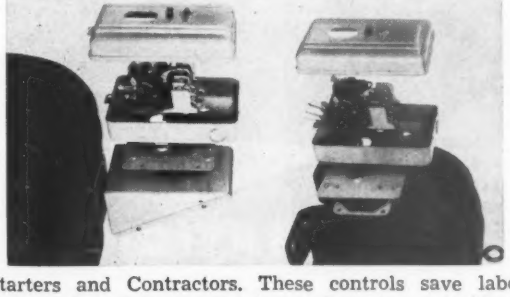
NEW DEVELOPMENTS • IMPROVEMENTS • COST AND TIME SAVERS — Mail FREE Inform-A-Gram Card for MORE Details

Master Gages for B-47 Statojet Bombers are now being made at the Boeing Airplane Co., Wichita, Kansas division with the aid of this 6″ Planer Type Horizontal Boring Machine, a product of the G. A. Gray Co., Dept. 14, Cincinnati 7, Ohio. The work illustrated on the boring machine is a master control gage used to make aft wheel master gages. **Circle No. A1.**



#3-AF Production Milling Machines made by Crowningshield-Harris Co., Greenfield, Mass., now are being used in the manufacture of long runs of small to medium sized parts for the defense industries as well as such items as small camera and automotive parts made of brass, aluminum and steel. They also are used to good advantage for milling plastics.
Circle Inform-A-Gram No. A2.

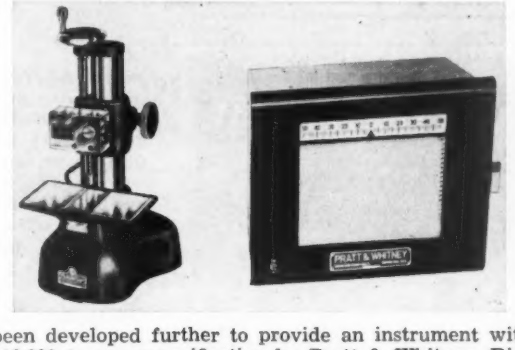
To Mount A Starter or Contractor directly to a motor quickly and at any position is a new idea in magnetic controls found in the Furnas Motor Mount



Starters and Contractors. These controls save labor and conduit between starter and motor; provide a safe, factory-made type of mounting installation. Made by Furnas Electric Co., 1072 McKee St., Batavia, Ill.
Circle Inform-A-Gram No. A3.

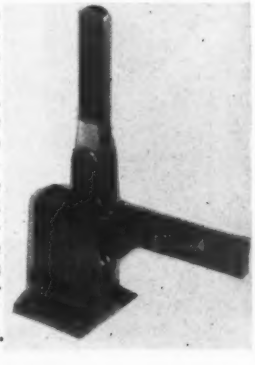
Many Different Drilling Jobs can be done on the new hood type multiple machine recently developed by B. M. Root Co., York, Pa. Equipped with universally adjustable spindles, the machine has an 18″ by 36″ rectangular drilling area. A 10 hp motor drives the spindles through a variable speed mechanism, which allows adjustment of the spindle rpm to suit various size holes and materials. A coolant system, with reservoir, pump and flexible spouts, directs a stream of coolant to each drill.
Circle Inform-A-Gram No. A4.

The Tried and Proven universal electrolimit circuit and gage block comparator stand combined with the recently developed P & W Electronic Recorder have



been developed further to provide an instrument with 110,000 to one magnification by Pratt & Whitney, Division Niles-Bement-Pond Co., West Hartford 1, Conn. Although primarily for checking precision gage blocks to the millionth of an inch, this instrument will undoubtedly find many other uses in industry where ultimate accuracy is required. **Circle No. A5.**

This Caddy Toggle Clamp with double clamping pressure is produced by Erico Products, Inc., 2070 E. 61st Place, Cleveland 3, Ohio. Among its many features are extra large pivot pins with up to 3 times more bearing surface; heavier links and handle to withstand extreme abuse; all welded construction; reinforced clamp bar to eliminate weak point where pivot pins pass through bar and heavier frame.
Circle Inform-A-Gram No. A6.



SEE ADVERTISERS INDEX, BACK OF BOOK, FOR INFORM-A-GRAM KEY NUMBERS

Drills, taps metal, wood, plastics. 2-minute setup on most drill presses; quick, accurate adjustment. Variety of models, ½" to 12⅝" centers.

The drill spindles are held rigidly in position when two nuts are tightened. Sturdily constructed. Suitable for adaptation to large or small drill presses. Models A and B made with sleeve. Models C and D with overarm adaptation, equipped with guide pins, springs and brackets, mounted to a cast-iron base with surfaces ground for use of drill fixtures. All models can be used for drilling or tapping on tapping machine or drill press with reversible spindle. Also used with standard tapping heads.

Multiple heads with fixed center distances are designed and built to meet your requirements. Available with GM Sleeves, Morse taper or drill chucks.

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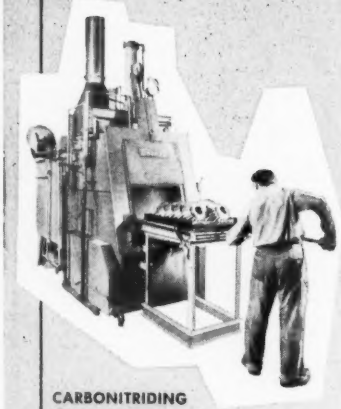
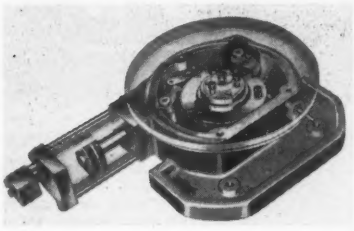
no other organization in the world covers the field so completely



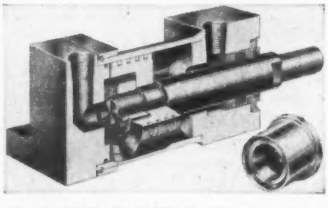
CARBONITRIDING FURNACES

LINDBERG
ENGINEERING COMPANY
2450 W. HUBBARD ST. • CHICAGO 12, ILL.

A Major Engineering Advantage of the new 11FA and 11FB dial feed tables produced by the A. K. Allen Co., 57 Meserole Ave., Brooklyn 22, N. Y., is a positive lock feature that stops the top plate from over-riding

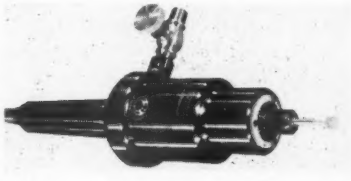


and losing index under the most severe conditions of operation. A hydraulic check also is offered as an accessory and provides a controllable shock absorbing effect at the end of every stroke for work that requires extra smooth operation. Accuracy of indexing is guaranteed to .002 measured at the periphery of the 11" top plate.
Circle Inform-A-Gram No. A7.



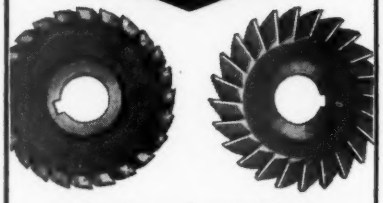
THE ABOVE PHOTO shows a cross-section view of the new hydraulic cylinder manufactured by the S-P Mfg. Corp., 12415 Euclid Ave., Cleveland 6, Ohio. Insert at lower right shows packing cartridge. This new cartridge unit can be taken out simply by removing a snap ring without dismounting the cylinder. Inform-A-Gram No. A8.

One of the First Attempts to Reduce Air Noise caused by air discharge in high speed air operated spindles is termed a success by Vulcan Tool Co., 730 Lorain Ave., Dayton 10, Ohio. The firm's new Vul-



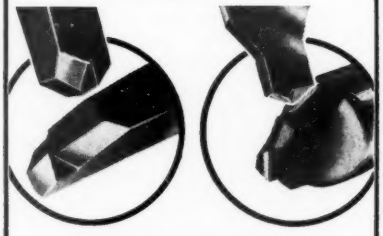
canaire high speed jig grinders and spindles are now equipped with mufflers that eliminate approximately 60 per cent of air noise due to discharge. By dissipating the exhaust energy through hundreds of small openings, each capable of handling small sections of air, the resulting flow enters the outside atmosphere in a much smoother manner.
Circle Inform-A-Gram No. A9.

Since 1912 WE'VE HELPED SHOPS SAVE MONEY



WORN and OBSOLETE CUTTERS RECLAIMED

YOUR CUTTING TOOL COSTS can be cut by converting worn and obsolete high speed and carbide cutters for other jobs. Let us help you set up a tool salvage program.



CARBIDE TOOLS FOR DRILLING HARDENED STEEL

These designs have been proved in our shop. Drill holes and centers in steel hard as 66-C fast, accurately and without annealing.

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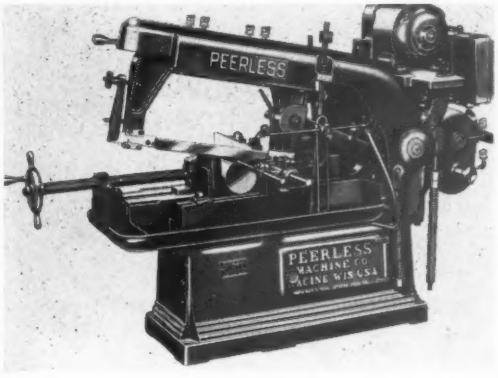
NATIONAL TOOL SALVAGE CO.

6511 EPWORTH BOULEVARD
DETROIT 10 MICHIGAN

Replacing the Standard 9" x 9" Standard Cutting Saw produced by the Peerless Machine Co., 1600 Junction Ave., Racine, Wis., is a new 10" x 10" model. The latest cutting saw is an over-arm type with an open saw

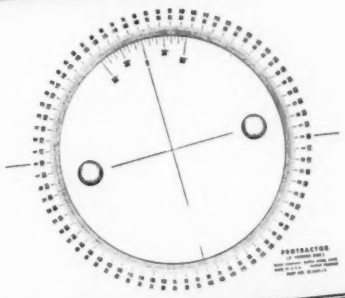


frame to permit loading from front or side. The over-arm is much heavier than the tool it replaces. The table of the new machine provides good working surface and the work clamping vise is arranged to clamp work from 90 to 45°. The holding jaw is quickly and easily set at the desired angle and the clamping jaw adjusts itself automatically to the work.
Circle Inform-A-Gram No. A10.

Exceptional Accuracy and quality of finish are said to be offered in the new Magerle tool and production surface grinding machine. It is also reported to complete repeated loadings of the chuck automatically to within .0002 of required size. The automatic fea-

ture of head feed is controlled by an independent electrical circuit, using a solenoid to operate the feeding machine. Included as standard equipment is a built-in wheel dresser. The table motions are hydraulically powered. Separate motors are provided for each operation. The Pellow Machine Co., 13500 Foley Ave., Detroit 27, Mich., as factory representative is introducing the Magerle machines.
Circle Inform-A-Gram No. A11.

.125 PRECISION PLASTIC



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ACCURATELY TO 5' OF ARC WITH NEW
Optical Comparator Protractor

For any projector or comparator not equipped with screen rotation. No special staging or fixtures required .... sturdy, accurate and moderate in cost.

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Surface Plate Equipment

MADE OF HIGH-GRADE SEMI-STEEL — HEAT TREATED AND PRECISION GROUND

STRAIGHT EDGES — For scraping planer and lathe bed ways . . . parallel straight edges for inspection of alignment and bearing surfaces of machine tools.

RIGHT ANGLE IRONS — May be placed in almost any position with work clamped to face for measuring . . . Also used as height blocks.

ANGLE PLATES — Made in 22 sizes from 2¾ x 4¾ x 4¾ up to 24 x 24 x 24 for clamping and holding work.

V-BLOCKS — Feature ribbed sides, light weight and a V accuracy of .0005 inch . . . for supporting shafts for drilling, checking, etc.

BOX PARALLELS — Complete range of sizes for every use . . . Accurate to .0005 inch.

Send for complete information

THE CHALLENGE MACHINERY COMPANY
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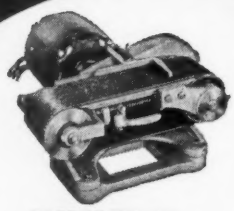

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ABRASIVE BAND GRINDER

The precision of a machine tool plus the durability of a workhorse. Complete with ½ H.P. Heavy Duty Motor and automatic band tension control. Nothing like it for finishing metals, plastics, wood, fibre, etc.

OTHER STYLES AND SIZES IN NEW MANUAL ON FINISHING WRITE TODAY

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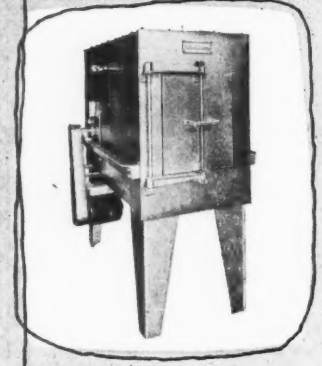
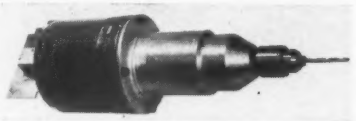


TOOLROOM CYCLONE
TEMPERING FURNACES

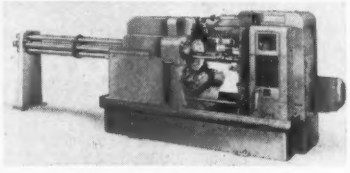
LINDBERG
ENGINEERING COMPANY
2450 W. HUBBARD ST. • CHICAGO 12, ILL.

A Redesigned Automatic Drill manufactured by Precision Thread Engineering Co., 2540 Park Ave., Detroit 1, Mich., includes a lubricating oil bath to all moving parts



and a ball bearing motor especially made for intermittent duty. This self-contained drill has automatic forward and reverse movements of the spindle, can be mounted at any angle or plane and will drill several holes in a workpiece in one operation in a variety of different directions when used in a special machine.
Circle Inform-A-Gram No. A12.

New Automatic Bar Machines of the Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio, are being produced to extend into the



smaller size range the rapid set-up and precision working features of the company's previous models. The new 1¼" and ¾" machines incorporate the previous models' quadrant mechanism for eliminating changeable cams.
Circle Inform-A-Gram No. A13.

With Any Accurate Torque Wrench (of standard types found in shops and plants) plus the new torque testing fixture made by P. A. Sturtevant Co., Addison, Ill., it is

possible to do many more testing, inspecting and checking jobs. This new product provides an inexpensive means for testing all types of screws and thread fasteners for driving torque, heat treatment or ultimate strength as well as a practical means for standardizing specifications.
Circle Inform-A-Gram No. A14.

SAVE
ON PRODUCTION TOOLING COSTS WITH CARDINAL -SPEED VISE-

Send for literature...see how SPEED VISE will SAVE on YOUR production costs!

The SPEED VISE exclusive, quick-acting clamping mechanism accommodates a wide variety of parts. DRILL JIGS are simpler, smaller, cheaper when used in a SPEED VISE.

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GLENDALE, CALIFORNIA

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With the AMIC "Quick-Action"
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The perfect tool for machine shop, tool room inspection and Quality Control. A flick of the thumb and you've got your external and internal dimensions. Knife-edged hardened jaws provide exact thread measurements. A depth gage blade gives speedy measurements. AMIC designed and made exclusively for AMIC by an outstanding European manufacturer.
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Size 6" No. 21B, Graduation 1/40", vernier reading .001.
No. 22B, Graduation 1/40" and full MM, vernier reading .001 and 1/10 MM.
Write for Circular A. Dealers inquiries invited.

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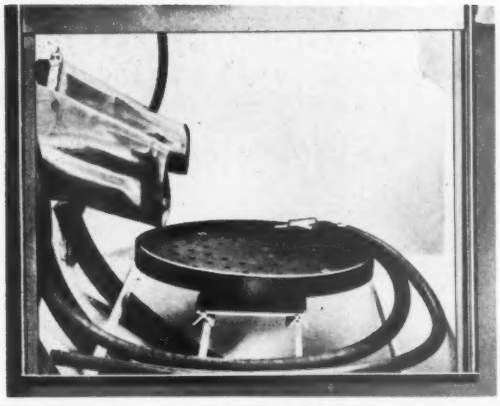
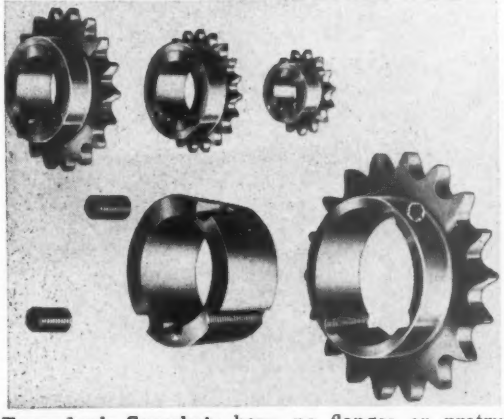


Precision Cleaning and Finishing Applications involving small pieces that can be lifted and handled manually is the function of a new wet blasting machine made by American Wheelabrator & Equipment Co., 1183 S. Byrkitt St., Mishawaka, Ind. A typical application is in the maintenance of small stamping dies. Photo shows inside blasting compartment.
Circle Inform-A-Gram No. A15.

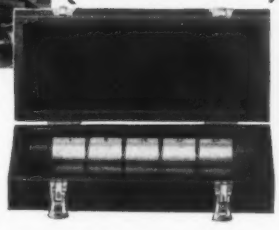
This Type A Dual Head "Rotomatic" with completely automatic cycle and an inexperienced operator completed in 40 seconds the same operations previously accomplished in 4 minutes by two expensive machine tools and two experienced operators. Produced by Standard Electrical Tool Co., Mt. Hope & Sixth Sts., Cincinnati 4, Ohio, the "Rotomatic" grinder has such multiple features as predetermined angular movement, ASSN spindle nose, rotary magnetic chucks, plus hydraulically controlled air cylinders for each grinder.
Inform-A-Gram No. A16.



Taper-Lock Sprockets have no flanges or protruding parts and require no more space than standard ones. Yet, they are hub-designed for safe operation and fit any roller chain manufactured to American standards, No. 40 through No. 100. Additional information can be secured from Morse Chain Co., 7601 Central Ave., Detroit 10, Mich.
Circle Inform-A-Gram No. A17.

Check Surface Roughness Waviness and Lay INSTANTLY
. . . Right At The Machine

With ACME'S ROUGHNESS COMPARISON SPECIMENS



Consists of various surface specimens, *individually finished* to definite micro-inch readings, grouped together in one handy comparison bar. Merely hold bar opposite work for fast, visual comparison check of surface roughness, waviness and lay.

Available in groups of 3, 5 and 8 specimens. Low cost. Write for details, now!

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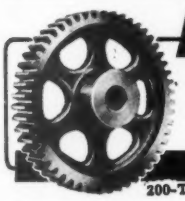

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TO BE CERTAIN — SPECIFY G. S. SURFACE PLATES AND ANGLE IRONS

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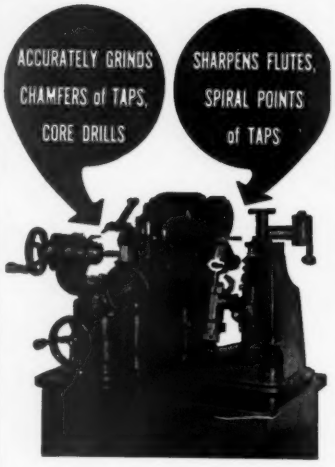
The Model 1100 Hybco Tap Grinder



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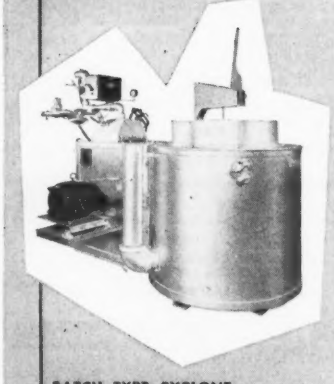
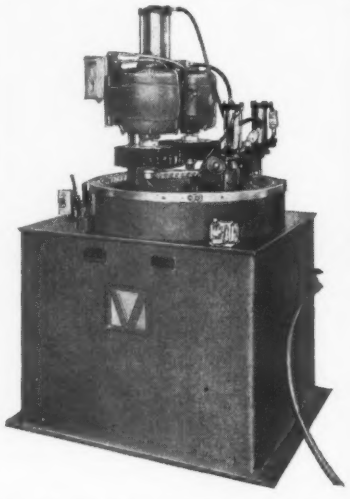


BATCH TYPE CYCLONE TEMPERING FURNACES

LINDBERG ENGINEERING COMPANY
2450 W. HUBBARD ST. • CHICAGO 12, ILL.

A New Turntable Type Deburring Machine for rapid deburring of jet turbine compressor stator rings, half rings or ring sections, has been developed by Grinding & Polishing

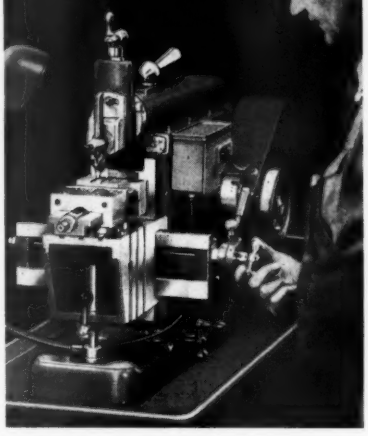


Machinery Corp., 2530-G Winthrop Ave., Indianapolis 5, Ind. Provision is made for holding ring sections to very accurate diameter during deburring operation by interchangeable holding fixtures for different diameters of workpieces.
Circle Inform-A-Gram No. A18.

Redesign of Its Hydraulically Operated bending machines for a more evenly distribution of stress and strain developed during bending and for keeping mechanical distortion to a minimum has been announced by O'Neil-Irwin Mfg. Co., 626 Eighth

Ave., Lake City, Minn. The company reports that changing the design of the bending table from fabricated steel to a strongly-ribbed alloy casting provides greater strength during bending operations and also allows the integration of gear housing into the casting to assure positive alignment at all times.
Circle Inform-A-Gram No. A19.

SOUTH BEND 7" SHAPER



Cuts Cost OF MACHINING SMALL PARTS

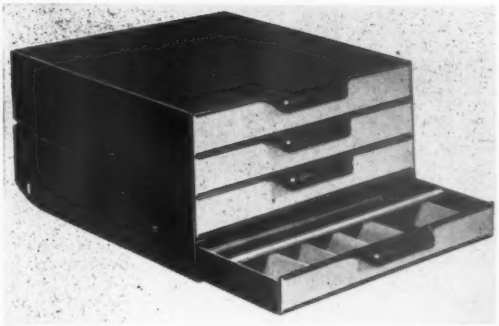
It's fast — accurate — easy to operate. The South Bend 7" Precision Shaper can consistently give you low machining costs on small parts. Designed to handle a wide variety of work, it will enable you to release larger shapers for heavier jobs, save on machine investment and economize on both power and upkeep. Find out how this versatile shaper can give you better service on production, toolroom or maintenance machining. *Write for literature.*

SPECIFICATIONS

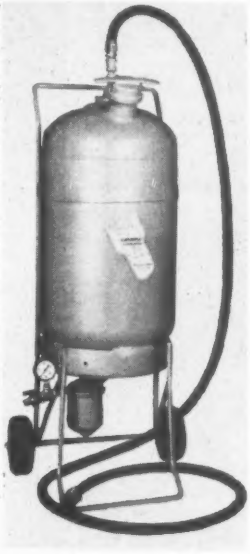
RAM Stroke — 0 to 7". Strokes per minute (4)—42 to 195. Cutting speeds—3 to 114 per minute.
TOOL HEAD Vertical feed — 3". Swivels 360°. Tool post slot size—3/8" x 13/16".
TABLE Horizontal travel—9½". Vertical travel —5". Power cross-feeds (6)—.002" to .012". Ram clearance—1/2" to 5-1/2". Table size—6-5/16" x 5" x 5-3/8".
VISE Jaw width—4". Jaw depth—1". Maximum opening—4".

SOUTH BEND LATHE
SOUTH BEND 22, INDIANA
Building Better Tools Since 1906

South Bend MACHINE TOOLS



A New Idea in small parts storage is the above "Little Gem" tiny parts cabinet. Each drawer is furnished with 8 dividers. Manufactured by Precision Equipment Co., 3714 Milwaukee Ave., Chicago 41, Ill., the cabinets come in baked green finish and weigh 10 lbs. **Circle Inform-A-Gram No. A20.**



The "Block Buster", a new easy-to-operate portable sand blasting machine is now being marketed by the Corson Co. Investment Bldg., 15th & K Sts., NW, Washington 5, D. C. Some of the specific time and saving uses of the Block Buster are cleaning sub-assemblies and parts before magna-fluxing or after heat treating in aircraft manufacturing; cleaning iron, steel, brass and aluminum castings, removing forging scale, rust and mill scale etc. The machine uses any clean dry sand that will pass through a 16 gage screen and has no moving parts to wear out. It operates from any direct air line or compressor having 80 lbs. or more pressure and the average air consumption is 30 to 35 cfm depending on pressure used. **Inform-A-Gram No. A21.**

A New Low Temperature Bench-Type Test Chamber is the most recent development of the Industrial Freezer Div., Webber Mfg. Co., 2740 Madison Ave.,

Indianapolis 3, Ind. Designed primarily for the armed services, the chamber is capable of extreme temperature ranges within a relatively short time. The application of heat is accomplished through the use of reverse cycle refrigeration, this eliminates the hazards associated with open heating elements. **Circle Inform-A-Gram No. A22.**

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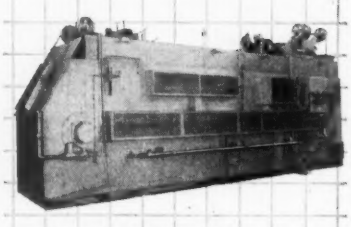


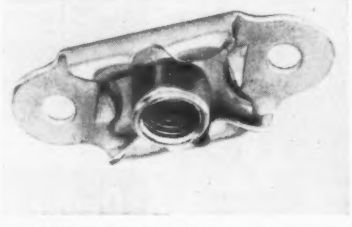
CONVEYOR HYDRYZING
HARDENING FURNACES

LINDBERG
ENGINEERING COMPANY
2450 W. HUBBARD ST. • CHICAGO 12, ILL.

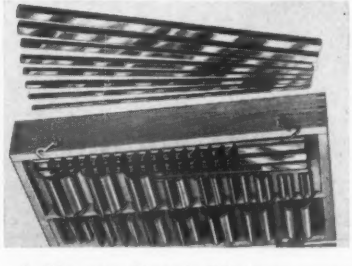
Changing Tools on the New Power Nibbler now being produced by Nord International Corp., P. O. Box 44-N139, Denville, N. J., is exceptionally easy due to a patented

lower tool holder that has the same centerline as the upper holder and a hand wheel for making speedy fine adjustments to any desired setting. The new "Nibbler" also has a detachable crankcase and beads, folds, cuts straight or circular, cuts louvers and slots.
Circle Inform-A-Gram No. A23.

THE KAYNAR COMPANY, 818 E. 16th St., Los Angeles 21, Calif., announces the introduction of its new F-5000 series, 2-lug floating anchor nuts



in 10-32 and ¼"-28 tap sizes. The "KAYLOCK" F-5000 series is produced from tempered spring steel and because of its all-metal construction can be used in applications up to 550°. Parts are normally furnished cadmium-plated, but are available in other finishes for special applications.
Circle Inform-A-Gram No. A24.



A Keyway Broach Kit that covers all hole sizes in 1/8" and 1/16" increments is now being produced by DuMont Corp., Greenfield, Mass. only. The No. 1-1A Combination Kit provides broaches and bushings for standard width keyways in 18 bore diameters confirming to American key standards. By interchanging broaches and bushings, 36 different combinations of keyways can be cut.
Circle Inform-A-Gram No. A25.

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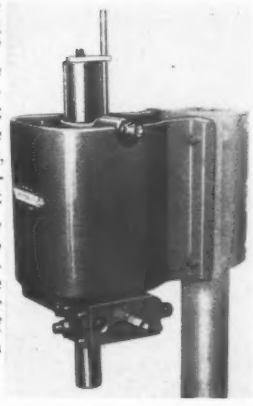
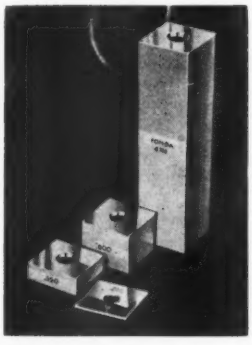
Now Available as a separate unit, the head of the Model Z-2, 12,000 lb. "Exploded Air" impact hammer may be mounted at any angle or upside down to handle difficult operations. According to the manufacturer, Air-Hydraulics, Inc., Jackson, Mich., this hammer may be used for light stamping, forgings, trimming, molding, crimping, coining, riveting, staking or forming. It operates at 100 psi line pressure with 50 strokes per cubic foot of air at a rate of 60 strokes per minute with hand or foot control.
Inform-A-Gram No. A26.

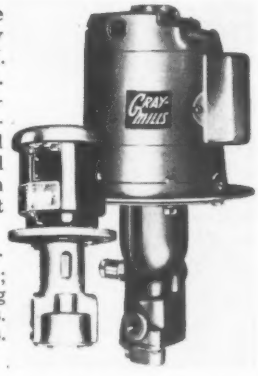




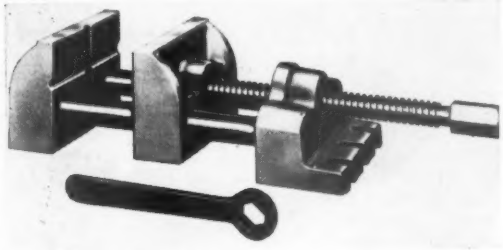
With the Inclusion of Square Gage Blocks, Fonda Gage Sales Corp., 38 Broad St., Port Chester, N. Y., now has on hand square and rectangular blocks in steel, carbide and chrome carbide. Quick identification of the square blocks is provided for by the numbering on the ground band of the larger blocks and etchings on the gaging surface of the smaller ones.
Inform-A-Gram No. A27.

Gear Pumps in a new line have been introduced by Graymills Corp., 3705-33 N. Lincoln Ave., Chicago 13, Ill. Unusual compactness and convenient of mounting and positive alignment are special features. Pumps are mounted vertically, either immersed in shallow tanks or with inlet pipe dropped to the liquid.

Pumps are designed for coolants, oils, solvents, emulsions; for machine tools, circulating systems and small sprayers. They come in three basic sizes.
Inform-A-Gram No. A28.



A Complete Line of drill press and machine vises in jaw widths of 3", 4½" and 6" has just been announced by the Wilton Tool Mfg. Co., 925-941 Wrightwood Ave., Chicago 14, Ill. These newly designed tools are built to close tolerance and because of a comparatively simple design which has eliminated dead weight are available at economical prices. Main parts are cast of high grade grey iron and the vises are fitted with a precision cut Acme spindle.
Circle Inform-A-Gram No. A29.



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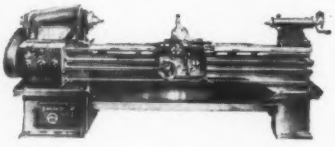
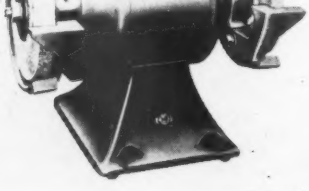
Several New Features are added to the Simplex 20″ lathe manufactured by Morey Machinery Co., 410 Broome St., New York 13, N. Y. Relatively heavy, the structure of

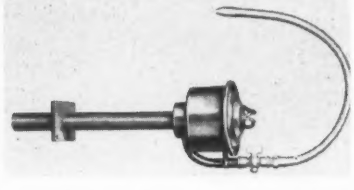


the lathe bed and units check out to recognized precise standards of accuracy. The spindle is hardened and ground with American standard spindle nose and especially helpful also, is the gap bed which swings 30″ and is of removable-block type besides being reinforced. **Circle Inform-A-Gram No. A30.**



Plants, Maintenance Shops and Production Departments with limited requirements will benefit by the ¼ hp double arbor 6″ lathe-type bench grinder designed by Porter-Cable Machine Co., 14 Exchange St., Syracuse, N. Y. The new machine has a totally enclosed motor with dynamically balanced rotors and can be used for general duty. **Circle Inform-A-Gram No. A31.**

A Self-Contained Motor-Driven Coolant Pump that is quickly and easily adaptable to a wide range of work is a new product of Viking

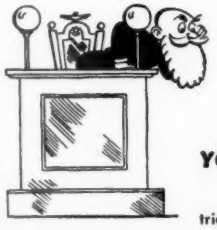


Industries, 220 Montague St., Rockford, Ill. The model is individually powered by a 1/30 hp oil-sealed motor and is designed to operate efficiently with all types of water soluble coolants and oils up to 20 SAE viscosity. It is also ideal for interchangeable applications. **Circle Inform-A-Gram No. A32.**

FOUND!
A SIMPLE FORMULA TO END SCALE — PITTING — DECARBURIZATION!

The proven, positive method to get mirror smooth finishes on all applications up to 1650°F.
Phoenix Brand Non-Scaling Compound completely seals out air to prevent surface imperfections during heat treating. This means brighter, better finishes — virtually eliminates costly polishing and grinding. Furnace capacity — and *production* — is no longer limited by bulky, clumsy packs.

FOLLOW THESE SIMPLE STEPS . . .
FOR FOOL-PROOF, FLAWLESS HEAT TREATING
★ Coat piece with dry, easily handled Phoenix Brand Non-Scaling Compound.
★ Harden or anneal in usual way.
★ Remove protective coating — by boiling in plain water, if necessary.
That's all there is to getting bright, pitless surfaces — without a trace of scale or decarburization.



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25 Lbs. or more.....$2.50 per lb.

Available from your local distributor or
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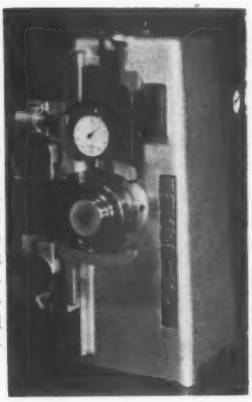
More Accurate Measuring of radial play in ball bearing is made easier and faster with a new pivotalarm type, radial internal clearance instrument produced by Sheffield Corp., Dayton 1, Ohio. It features two easily adjustable, air-operated load bearing arms that alternately exert upward and downward pressure on the bearing. At the same time it measures the successive movements of the outer ring to determine the amount of radial play of the bearing in that position.



Inform-A-Gram No. A33.

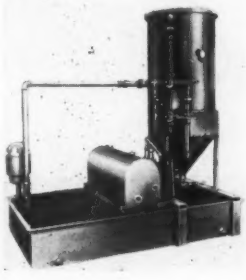
A NEW 3" IN 1" SHOP TRUCK manufactured by the Unit Mfg. Co., Dept. 156, 1229 Harmon Place, Minneapolis, Minn., features a hydraulically operated boom that handles all lifting jobs up to 8 feet. Loads of 750 lbs. are easily handled by the one-hand operation of the unit's 5,000-pound hydraulic system. For easier lifting in close quarters, the base of the truck is on 22½" x 33" and has a foot operated lock brake. The forks can be placed in operation with the switch of one pin and need only 3¼" clearance and will lift a pallet to 55". To lift non-palletized loads, a platform is locked over the forks. Additional information on this new hydraulically operated shop truck will be furnished by the manufacturer upon request.

Inform-A-Gram No. A34.

A New Hydraulic Gap-Type Press for jobs that require accurate pressures up to 20 tons is now being marketed by Studebaker Machine Co., 1221 S. 9th St., Maywood, Ill. Called Model 220G, this press was designed for fast operation on jobs such as forming, drawing, forcing, etc. Large gap-type frame makes the press practical for unwieldy jobs. It has a sturdy motorized hydraulic system with a rapid ram speed and stroke control made to customer's specification. It is equipped with pressure gage and adapter.

Inform-A-Gram No. A35.

GREATER FILTERING CAPACITY plus low operating cost is offered with the new Houdaille "J" Type Coolant Clarifer developed by Honan-Crane Corp., 208 Indianapolis Ave., Lebanon, Ind. The compact, multiple filtering tube unit features over 16,000 square inches of filtering area. It removes all chips, abrasives, dirt and other solid contaminants from both water based and mineral oil coolants used in individual machine tools or small central systems. The clarifier can be operated continuously and independent of the machine tool.



Inform-A-Gram No. A36.

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of all popularly-priced Tool and Cutter Grinders sold in 1952 were "Knock-Outs"

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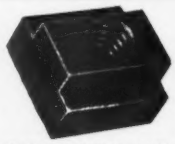

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The Monochromatic Light Generator produced by the DoAll Co., Des Plaines, Ill., features a 20" diameter, high intensity light source. This "Monolight" instrument was developed to meet demands for

greater capacity so that large parts or large numbers of smaller parts can be checked easily for surface flatness, finish, dimensions, etc. The advantage of the large work area is particularly valuable in checking crystals of quartz, germanium or other composition used.

Circle Inform-A-Gram No. A37.

The Mead Rotary Work Feeder is of such compact design and low silhouette as to be readily adaptable to a great variety of jobs. The example illustrated here saved considerable time in the feeding of brass plugs to a slotting operation. The work feeder indexes with each

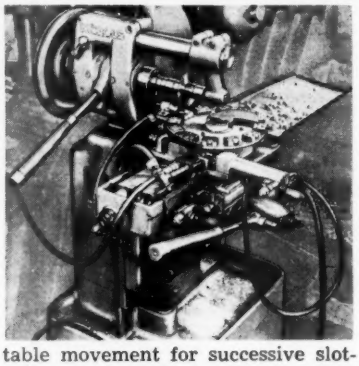

table movement for successive slotting operations. The entire sequence of operations, i.e., indexing, clamping of workpiece, slotting, unclamping and ejecting, is partially automatic, depending upon operation to actuate the milling table feed levers and to load the brass plugs on the rotary table. Mead Specialties Co., Dept. M-32, 4114 North Knox Ave., Chicago 41, Ill.

Circle Inform-A-Gram No. 38A.

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With Micrometer Adjusting Screw
HARDENED STAINLESS STEEL
Overall Length 12" *Measuring Capacity 8½"*

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World famous for accuracy. Hand fitted Vernier slide insures smooth, snug operation. Wide Vernier, exceptionally easy to read. English or English and Metric graduations. LENGTHS UP TO FIFTEEN FEET CAPACITY! Handsome, form-fitting wooden case.

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17/32	7.00	21/32	9.00	13/16	12.00
35/64	7.70	43/64	9.20	27/32	12.50
9/16	7.70	11/16	9.20	7/8	13.20
37/64	8.25	45/64	9.40	29/32	14.00
19/32	8.25	23/32	9.40	15/16	14.50
39/64	9.00	47/64	9.60	31/32	15.50
5/8	8.80	3/4	9.60		

15" CUTTING FLUTE, 20" OVERALL

1	$18.00	1-1/8	$22.50	1-1/4	$25.00
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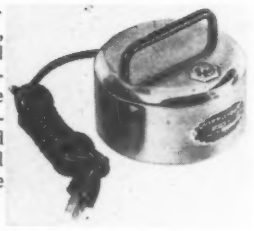
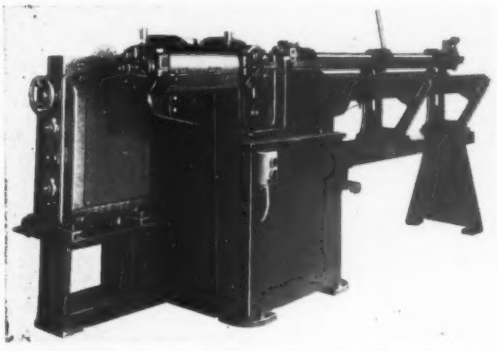


Jiffy-Rase, a product of Rason Mfg. Co., 3050 W. 21 St., Brooklyn 24, N. Y., will end needless delay on the production line by eliminating the tedious job of brushing, wiping and picking filings and drill shavings off magnetized metals and tools. Jiffy-Rase de-magnetizes the waste.
Inform-A-Gram No. A39.

Heavy Duty Filters for removing water and oil from compressed air lines are presented in two new forms by Air-Line Engineering Co., 198 Wayne St., Mansfield, Ohio. The new standard filter is tested for 500 pounds per square inch. In addition there is a new water-cooled unit with a steel 8" jacket added to permit a flow of cooling water around the outer shell. The water-cooled filter functions as a combined after-cooler and filter to provide maximum condensation.
Circle Inform-A-Gram No. A40.

A Miniature Pneumatic Transmitter for measuring and transmitting readings of temperature, pressure and vacuum readings to recording receivers has been announced by Bristol Company, Waterbury 20, Conn. The new transmitter uses standard Bristol measuring units and a simple transmitting mechanism with only one pivot and no flexures. Friction and lost motion are thereby eliminated for all practical purposes. The Transmitter weighs 7½ lbs., is weatherproof and will operate in any position.
Inform-A-Gram No. A41.

A Variable Speed Drive, geared to feed infinite speed changes from 50 to 200 feet per minute, is one of the features of the new Shuster 1AV automatic wire straightener and cutting machine. Because the



machine, produced by Mettler Machine Tool, Inc., New Haven, Conn., will handle both basic and spring wire, it has exceptional versatility. Diameters from 3/32" to ¼" basic wire may be straightened and cut without no more adjusting than turning the control handle of the variable speed drive.
Circle Inform-A-Gram No. A42.

IMMEDIATE DELIVERY

on SOCKET HEAD CAP SCREWS

. . . Up to 12" Long!

on ½", ⅝" and ¾" Dia. Screws

and No Special "Set-Up Charges"

WHY HOLD UP YOUR WORK . . . for long deliveries on those so-called "special length" screws? You can get really fast service on high-quality Socket Head Cap Screws, Stripper Bolts and Dowel Pins . . . AND you don't have to pay special set-up charges either! D-M-E's large volume turn-over enables you to get in on the savings!

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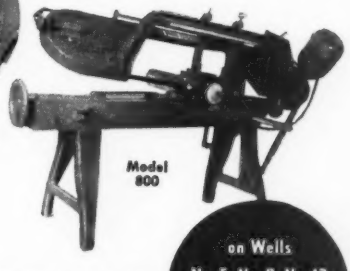
NOW Wells offers you fool-proof blade tensioning . . .

Above is a close-up of the new Wells blade tensioning device.



Model 800

on Wells No. 5, No. 8, No. 12 and Model 800 cut-off saws

NOW IT IS POSSIBLE to maintain a constant blade tension on Wells cut-off saws. You can replace or change the blade any number of times, yet quickly and easily duplicate the correct blade tension. The new device is standard equipment on the models listed above. Simply turn the tension hand wheel until the fixed and moving indices coincide. At this point the blade tension is correct regardless of variation in blade length.

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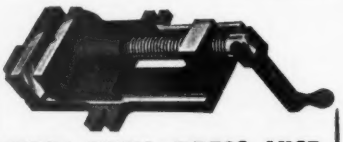

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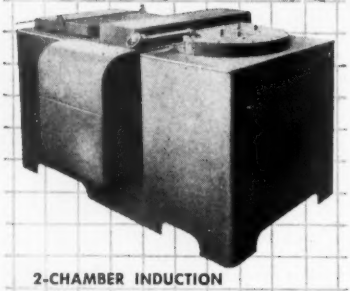

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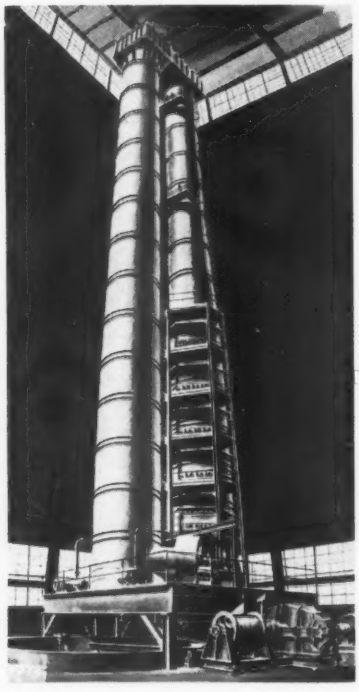
The world's tallest furnace — high as a 13-story building — is being built by the Westinghouse Electric Corporation at its Industrial Heating Department plant in Meadville, Pa. The furnace's 130-foot vertical tower will be used to heat-treat long, extruded aluminum shapes required primarily by manufacturers of airplanes. Aluminum pieces 110 feet long will be suspended in the tower for specified periods of time. At the end of the heat bath, the suspended pieces will be quenched in a water-filled pit of the same depth. In a furnace such as this one, the temperature difference between the top of the tower and the bottom must be slight. In this Westinghouse gas-fired unit, there will be a maximum temperature difference of less than five degrees. This is accomplished by maintaining a high rate of air circulation. The furnace is scheduled for completion about the middle of 1954.



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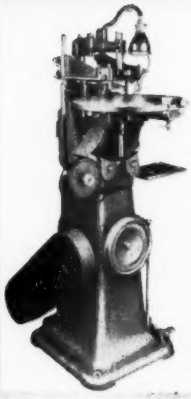

Oliver Die Makers have been cutting costs for 40 years, saving toolrooms up to 60% and better in time and expense over hand methods of making dies. In thousands of plants throughout the world Oliver Die Makers are meeting production demands, giving long-lasting service (many Olivers have been in continuous use for more than 30 years), speedily, accurately, dependably. Skilled labor is not required on an Oliver due to the simplicity of operation. Modernize your die making methods the cost-cutting Oliver Way . . . Be Wise, OLIVERize.

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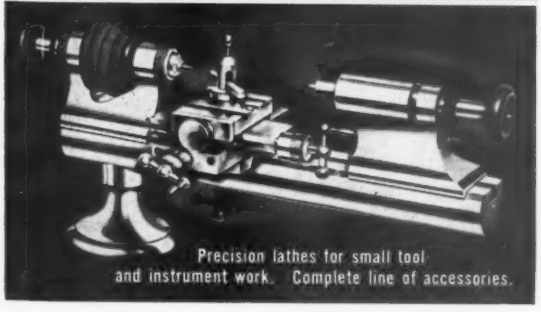

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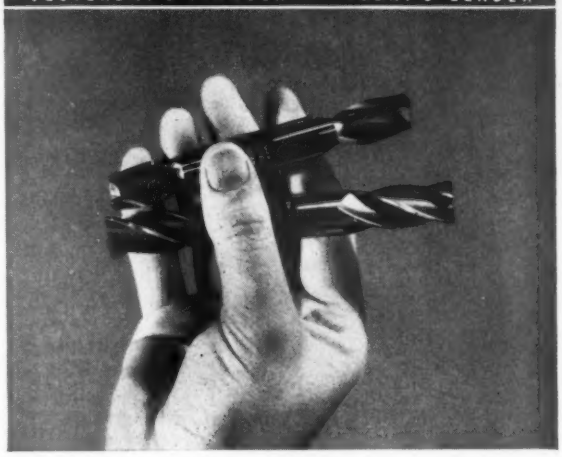

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FOR DOUBLE DUTY

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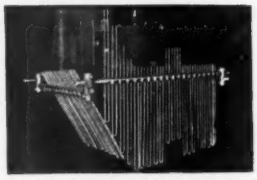

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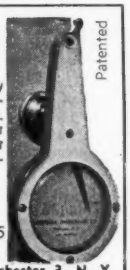

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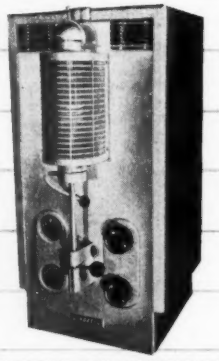

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IMPROVEMENTS IN ECONAWAY ABRASIVE BELT SPLICER

Improvements and changes in the Econaway Abrasive Belt Splicer, designed to increase the speed of splicing abrasive belts, improve the quality of splice, save shop bench space and allow a still larger saving in the cost of abrasive belts, have been announced.

The improvements include: an enclosure for the motor, the belt drive and the arbor which carries the grinding wheel; cutter and press bars are now mounted on top of the enclosure so that the operator can perform the various steps in splicing any grit paper or cloth backed abrasive belts without moving from one station to another; an electrical curing press to reduce the curing time from 24 hours to less than 60 seconds. (The original unit employed a multiplicity of "C" clamps and required a 24 hour curing time.) Thus, there is not only a considerable reduction in the actual splicing time but abrasive belts may now be spliced even while a sanding machine waits, since the splicing operation is completed so quickly and the newly spliced belt can be put into service instantly. An additional advantage is the reduction in space required for storing the belts during the 24 hour curing time as required with the old cold-press process. A vast increase of speed of clamping with the toggle type clamps, which are fastened to the lower segment of the press, is apparent when contrasted with the use of "C" clamps. Moreover, the toggle type clamp is always in position for instant action.

The new press is not only electrically heated but the temperature is controlled at the correct level by a preadjusted thermostat.

Photo courtesy Aget-Detroit Co.

While estimates of users of the original Econaway Abrasive Belt Splicers indicate a saving of not less than 50% over the cost of buying belts already spliced, the new improved splicer, with capacity for splicing abrasive belts in any width up to 14", indicates an even greater saving.

Quick accessibility is provided for the occasional oiling and greasing of the motor and precision ball bearing arbor respectively and also for dressing the grinder wheel. The electric heater (a 250 watt Chromalox element) is controlled by a Fenwall (or equal) adjustable temperature thermostat. Both are enclosed in the upper press segment and are quickly removable for inspection or adjustment. A 6 foot "plug-in" cord is protected against wear at its point of entry into the press by a spring and bulkhead bushing.

Shipments of the improved Econaway splicer are being made from stock and are accompanied by detailed instructions for making joints in abrasive belts amply strong to withstand any pull normally encountered in regular use.

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BLACK GRANITE SURFACE PLATES

Present an absolute continuous bearing surface, finished up to 50 millionths inch. Incredibly smooth. Falling objects do not cause humps. Being harder than hardened steel, can take greatest mistreatment without causing inaccuracy of surface. No oiling. Will not rust or warp. No re-scraping. Most durable.

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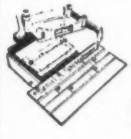

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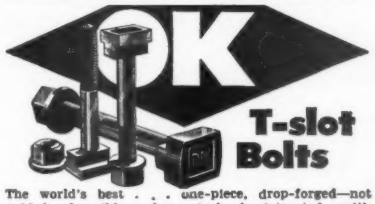

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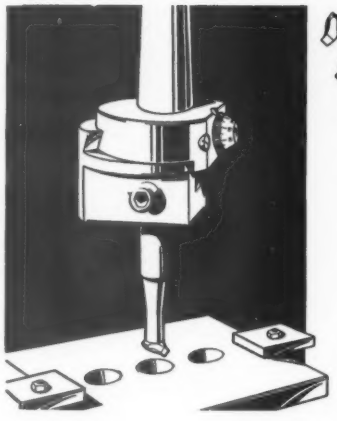

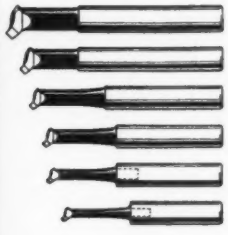

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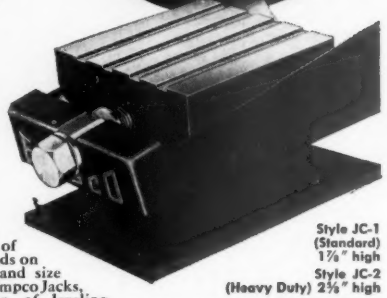

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Empco Jacks enable you to meet hurry-up demands for relocation of machinery by giving you the fastest, easiest, most accurate machine leveling ever known: you simply raise or tilt machine sufficiently to allow the Empco Jacks to be slipped under base. The number of jacks required depends on weight of machine and size of base. Once set on Empco Jacks, the entire operation of leveling and maintaining equipment level is quickly done. By applying a wrench to the "hex" head of adjusting screw, an adjustment is obtained either up or down until your level indicator reads "zero." Write for specifications and prices today.

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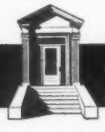

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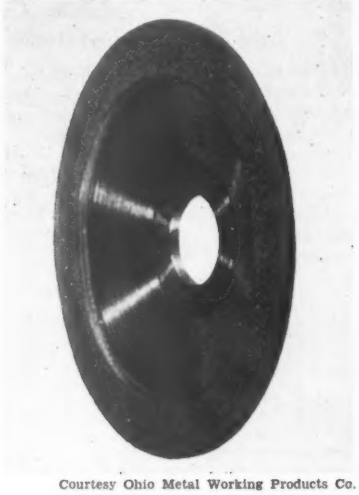
New Approach To Low Cost Diamond Wheel Grinding

Major economies in cost-per-tip carbide tool grinding are possible, using electroplated nickel-bond diamond wheels, now being introduced in this country. Developed by one of the oldest known producers of diamond tools and dies, the new bonding process deposits electrolytically a dense nickel bond around each diamond particle. This means that the diamonds are held more firmly than is possible with conventional materials, so that the diamonds do not break out or impact.



Courtesy Ohio Metal Working Products Co.

The non-porous nickel bond, due to its greater density, prevents the wheels from loading. In numerous instances, the nickel-bonded wheels have been completely used up without requiring any dressing. The ability of the manufacturer to accurately grade and sort the diamond boart by grain size is said to give the wheels consistently better and more uniform service and better finish on ground tools.

The unique bonding process requires the use of only one layer of diamonds which are applied to each wheel in the greatest concentration for the nickel to hold. Hence, the nickel-bonded wheel is less susceptible to damage by gouging and careless handling than the thicker, softer sintered-bond wheels. Initial cost of the new nickel-bond wheel compares very favorably.

Rapid cutting action gives a low hourly grinding cost, while the longer wheel life and faster action combine to reduce the per-tip costs to approximately one half the generally accepted national average.

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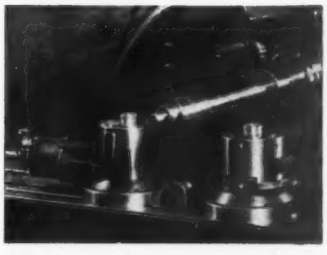

Operator merely loads and unloads.

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Zagar "Air-O" (air-operated) fixture has all basic features above; still further speeds up operation. Control by hand, cam, chain or other cycling connection. All parts are interchangeable. Typical Zagar ruggedness and craftsmanship. 1" and 2" sizes.

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. . . Automatic, from page 112

that they retain their hardness even when operating at elevated temperature; this property often being referred to as 'red hardness'. Thus, this property characteristic is quite satisfactory in both the tungsten and molybdenum base high speed steels, and, in addition, the property of toughness is equally satisfactory. However, where occasion may arise, especially in the machining of the tough material types, this red hardness property may necessarily have to be increased. Thus, the choice of tool material may be either the cobalt base high speed steels, or even the cast alloy or carbide tipped tools. These alloys exhibit a proportionally higher red hardness, however they also become less tough. In addition, machine speeds may normally be increased as the red hardness of the alloy increases. Therefore, in many cases, the choice of tool material on any specific operation may be a compromise between these two properties, red hardness and toughness.

The use of a cutting fluid is required; the dual function of this material being for lubrication and for cooling. The choice of lubricant is usually on the basis of personal experience, however in our specific case we can state that, (a) the 100 viscosity paraffin oil has usually been found satisfactory in the machining of the leaded copper alloys; (b) the mixture of a soluble cutting oil to kerosene at a ratio of 1:1 has been found quite acceptable in the machining of many of the screw machine type aluminum alloys; a very fine finish being obtained; (c) the tougher materials such as the stainless require a lubricant which has greater body; there being a variety of materials on the market which can be used; and (d) in the machining of a material such as the free machining steels, we have found that a similar lubricant, which has been further diluted, to that used for the stainless is satisfactory.

References

1. 'Construction and Use of Automatic Screw Machines' 1951 ed., Brown & Sharpe Mfg. Co., Providence, R.I.
2. 'Set Up and Operation of Brown & Sharpe Automatic Screw Machines', No. 1 to No. 14 Instruction Bulletins, 1952 ed., Brown & Sharpe Mfg. Co., Providence, R.I.
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4. 'Machining Copper and Copper Base Alloys', The Amer. Brass Co., Waterbury, Conn.
5. 'Machining of Armco Stainless Steels', Armco Steel Co., Middletown, Ohio.

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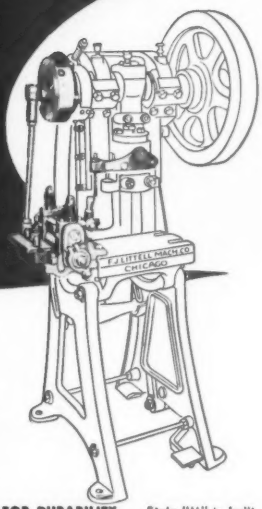

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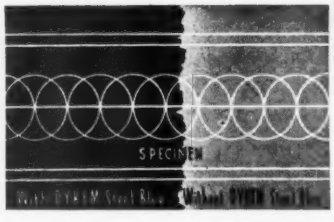

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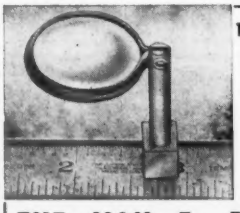

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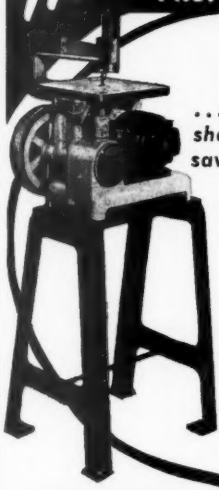

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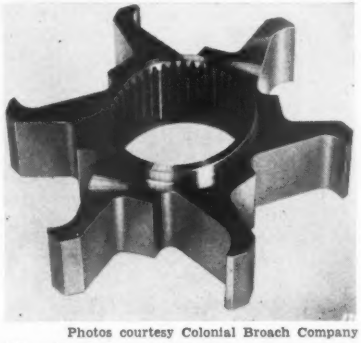
Spider Arms Broached on Single Ram

A combination manual and automatic control setup has been developed which permits the broaching of aircraft engine spiders on standard single ram broaching machines.



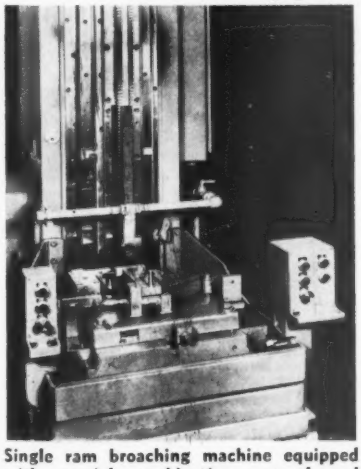
Photos courtesy Colonial Broach Company

Aircraft engine spider. Contours on arms are broached on single ram in six passes.

The machine shown is a 6-ton, 54 in. stroke single ram, used to broach six identical contours on the six arms of an aircraft spider.

In operation, the spider is placed in the fixture and clamped in place manually, locating from the splined hole. Each cutting stroke of the broach broaches the contours between one set of arms on the spider. When the circuit is actuated to start the broaching cycle, support jacks in the fixture automatically close in and support the two arms of the

. . . *Continued on page 153*



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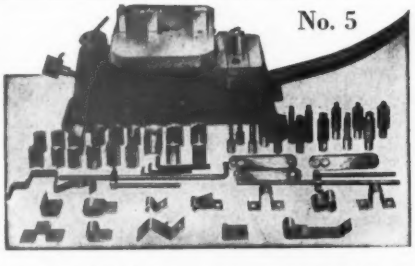

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2	3-9/16 x 2¼	square 2⅛	2	4	$37.50

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* Designed for easy production of compound angles.
* Completely graduated in three planes.
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* Polished steel finish.

	"JUNIOR"	"SENIOR"
Width of jaws	3"	4½"
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Depth of jaws	¾"	1-5/16"
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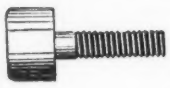

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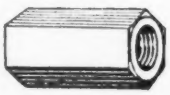

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WOODSON TOOL CO. 4811 Lennox Blvd. Inglewood, Calif. *Write for Catalog*

New Hydraulic Power Unit

A hydraulic power unit has been designed and built by a midwestern manufacturer which consists of a 12 GPM hydraulic pump and a 7½HP motor. The rest of the equipment

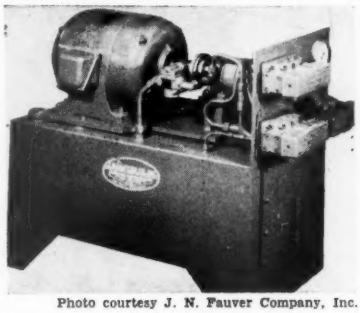

Photo courtesy J. N. Fauver Company, Inc.

includes a relief valve and three panel-mounted, solenoid operated, four-way control valves ... The tank holds fifty gallons — is equipped with a filter, breather, oil level gauge and baffles.

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The Gilbert S. Simonski Company, Neshaminy, Pennsylvania, makers of Lucifer Electric Furnaces, announces a change in name, effective June first, 1953, to Lucifer Furnaces, Inc., same address.

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phia, the firm designs and builds electric furnaces for heat treating purposes. Production capacity will be boosted as soon as plant expansion is completed.

. . . Spider Arms, from page 151

spider opposite the surfaces being broached. When the broach has completed the cut, the fixture automatically shuttles clear of the broach and the automatic support jacks are released. This allows the operator — while the broach is returning — to manually unclamp the part and index it in the fixture to the next position for broaching the adjoining set of contours. Then the cycle is repeated until all six contours between the six arms of the spider have been broached.

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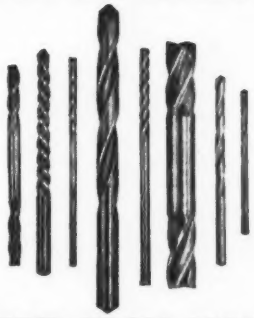

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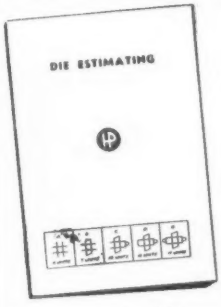

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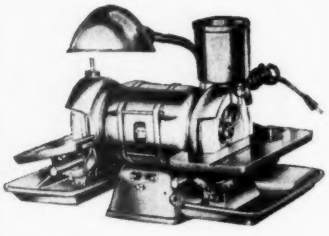

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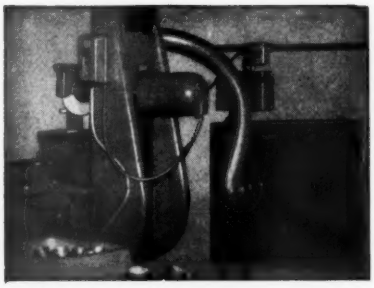

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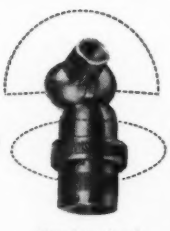
Patented, U.L. approved "RR" Swivel



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SAVE LABOR
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Industrial News

Three of the largest hydraulic stretching and detwisting machines with capacities from 750 to 1500 tons for straightening aluminum extrusions have been orderd from Loewy-Hydropress, Inc. These powerful machines will be operated in conjunction with a number of Loewy 8,000 and 20,000 tons aluminum extrusion presses now under construction for the U. S. A. F.

Hobart Brothers Co.'s new $3,000,000 electrode plant is more than a sleek modern building. It is a symbol of faith in the future of welding.

This new electrode plant is now in full production. Facilities include shipping and receiving docks for both rail and truck transportation, unique chemical and wire storage facilities, production, quality control, testing, research, and experimental departments. The ovens are the most modern and scientifically designed to automatically control the moisture content of the electrodes produced.

The building is of steel and masonry construction. Walls are constructed so that when expansion is required a specific wall may be removed to make room for extension.

Hydropress, Inc. has received an order for two self-contained oil-hydraulic extrusion presses from the Reynolds Metals Company in Richmond, Virginia. These presses are of the latest design enabling this company to extend its extrusion operations. This decision by one of the major aluminum companies is another indication of the growing interest of the industry in the extrusion market.

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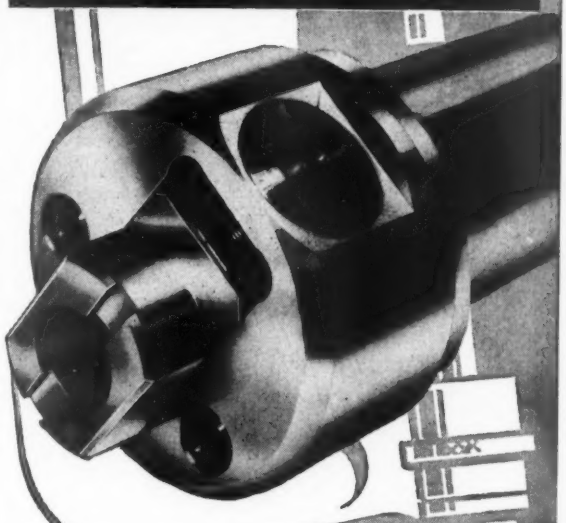

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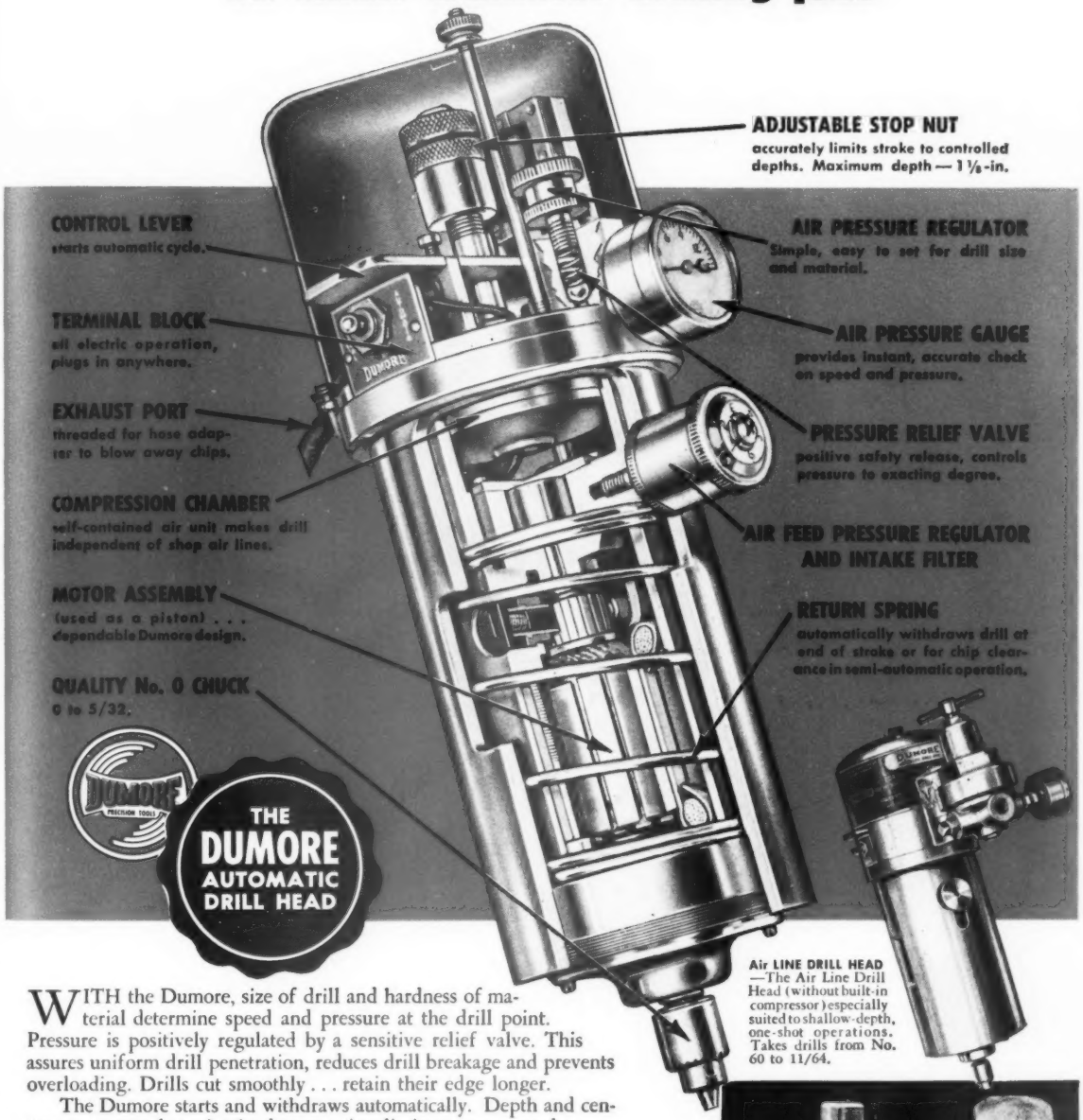
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AIR PRESSURE REGULATOR
Simple, easy to set for drill size and material.
TERMINAL BLOCK
all electric operation, plugs in anywhere.
AIR PRESSURE GAUGE
provides instant, accurate check on speed and pressure.
EXHAUST PORT
threaded for hose adapter to blow away chips.
PRESSURE RELIEF VALVE
positive safety release, controls pressure to exacting degree.
COMPRESSION CHAMBER
self-contained air unit makes drill independent of shop air lines.
AIR FEED PRESSURE REGULATOR AND INTAKE FILTER
MOTOR ASSEMBLY
(used as a piston) . . . dependable Dumore design.
RETURN SPRING
automatically withdraws drill at end of stroke or for chip clearance in semi-automatic operation.
QUALITY No. 0 CHUCK
0 to 5/32.
DUMORE
PRECISION TOOLS
THE DUMORE AUTOMATIC DRILL HEAD

Air LINE DRILL HEAD —The Air Line Drill Head (without built-in compressor) especially suited to shallow-depth, one-shot operations. Takes drills from No. 60 to 11/64.

WITH the Dumore, size of drill and hardness of material determine speed and pressure at the drill point. Pressure is positively regulated by a sensitive relief valve. This assures uniform drill penetration, reduces drill breakage and prevents overloading. Drills cut smoothly . . . retain their edge longer.

The Dumore starts and withdraws automatically. Depth and center are accurately maintained to exacting limits on every stroke.

As a result, even with relatively untrained operators, you get more production per day . . . less drill breakage due to operator error — even on jobs requiring No. 80 drills.

Self-contained, independent of shop air lines, the Dumore quickly adapts to any production arrangement, minimizes special tooling.

Available attachments: Bench Stand, Repeat Cycle Timer, Mounting Brackets, Foot Control Switch.

Ask your Industrial Distributor or write for complete details.

COMPACT IN SIZE — 14½" long, 4½" in dia. weighs 17½ pounds. Completely automatic, built-in controls. Meets a variety of installation applications.

DUMORE PRECISION TOOLS

The Dumore Company

1313 Seventeenth Street • Racine, Wisconsin

BENCO

better PUSHERS

"Reduced Type" Feed Finger

Squirrel Cage Pusher

Extraordinary production records with a wide range of feeds and speeds are not unusual on machines equipped with Benco Pushers or Feed Fingers. Benco Pushers are engineered and built to provide efficient, dependable feeding and the elimination of stock scoring. Continued dependable performance at lower production costs with resultant savings of time and money may depend on the proper selection of pushers and feed fingers...choose Benco and you'll choose the finest.

Always Better Constructed
Accurate Benco Collets, Pushers and Pads

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